TACMET Weather Station for Pole Mast Installations MAWS201MP

INSTALLATION MANUAL

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VAISALA

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CHAPTER 1

GENERAL INFORMATION

This chapter provides general notes for the product.

About This Manual

This manual provides information on installing TACMET Weather Station for Pole Mast Installations (later referred as MAWS201MP) and the sensors to the mast. This manual also gives guidelines on how to prepare foundations and install the DKP206AV-T and DKP210AV-T masts.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the product.
- Chapter 2, Product Overview, introduces the TACMET Weather Station for Pole Mast Installations.
- Chapter 3, Installation of the Mast, provides instructions for preparing the installation and selecting the site for the station. It also contains detailed information on installing the tiltable pole mast.
- Chapter 4, Installation of the Weather Station Components to the Mast, provides detailed information on installing the weather station logger and all the sensors to the mast.
- Chapter 5, Installing Indoor Components, provides you information that is needed in installing the MIDAS IV workstation and QCA101 Communication Accessory Enclosure indoors.

- Chapter 6, Technical Data, provides the technical data of the TACMET Weather Station for Pole Mast Installations.

Feedback

Vaisala Customer Documentation Team welcomes your comments and suggestions on the quality and usefulness of this publication. If you find errors or have other suggestions for improvement, please indicate the chapter, section, and page number. You can send comments to us by e-mail: manuals@vaisala.com

Safety

General Safety Considerations

Throughout the manual, important safety considerations are highlighted as follows:

WARNING	Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

CAUTION	Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

NOTE	Note highlights important information on using the product.

Product Related Safety Precautions

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. They are recommended precautions that personnel must understand and apply during many phases of installations, operations and maintenance.

WARNING For safety reasons, do not install the mast alone.

WARNING For safety reasons, do not install the mast when wind speed is over 7 m/s.

WARNING Always wear a safety helmet during mast installation.

WARNING Be careful when erecting or tilting the mast. See that there are no power lines or other obstacles above or behind the mast.

WARNING Secure the mast properly with guy wires to prevent it from falling. Tighten all the adjustment screws properly.

WARNING Be sure that there are no persons under the mast during erecting or tilting the mast.

WARNING When erecting the mast with the winch, do not touch the wire with your bare hands. Do not try to guide the wire.

WARNING To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The power cable must either be plugged into an approved electrical outlet or the instrument must be carefully grounded to a low-resistance safety ground.

WARNING Do not operate in an explosive atmosphere. Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

WARNING Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

WARNING Do not service alone. Under no circumstances should any person reach into parts and assemblies that are AC powered.

WARNING Operating personnel must not remove instrument covers. Component replacement or internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist for some time even with the power cable disconnected. To avoid injuries, disconnect power and discharge circuits before touching them.

WARNING Do not service the live system outdoors**.** Do not open units outdoors when the enclosure contains line voltage levels.

CAUTION Do not install substitute parts or modify the unit. Improper modification can damage the product or lead to malfunction. Contact Vaisala for repairs to ensure that safety features are maintained.

CAUTION Be careful not to damage the sensors when tilting the mast.

NOTE	Send old batteries to secondary lead smelter for recycling. Place neutralized slurry into sealed containers and handle as applicable with state and federal regulations. Large water-diluted spills, after neutralization and testing, should be managed in accordance with approved local, state, and federal requirements. Consult the state environmental agency and/or federal EPA (Environmental Protection Agency).

ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself with a wrist strap and a resistive connection cord to the equipment chassis before touching the boards. When neither of the above is possible, touch a conductive part of the equipment chassis with your other hand before touching the boards.
- Always hold the boards by the edges and avoid touching the component contacts.

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License Agreement

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Warranty

For certain products Vaisala normally gives a limited one year warranty. Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or conditions of sale for details of the warranty for each product.

Technical Support

For technical questions, contact the Vaisala technical support:

E-mail	helpdesk@vaisala.com
Telephone	+358 9 8949 2789
Fax	+358 9 8949 2790

CHAPTER 2

PRODUCT OVERVIEW

This chapter introduces the TACMET Weather Station for Pole Mast Installations.

Introduction to TACMET MAWS

TACMET MAWS is an automatic weather station designed for permanent installation. TACMET MAWS accesses and processes data from its sensors, performs data quality control, as well as formats data for output in application specific formats. Figure 1 on page 16 shows the components of the TACMET MAWS system.

The AWS logger QML102T is located in the tube and is encased to protect the circuit board and the battery.

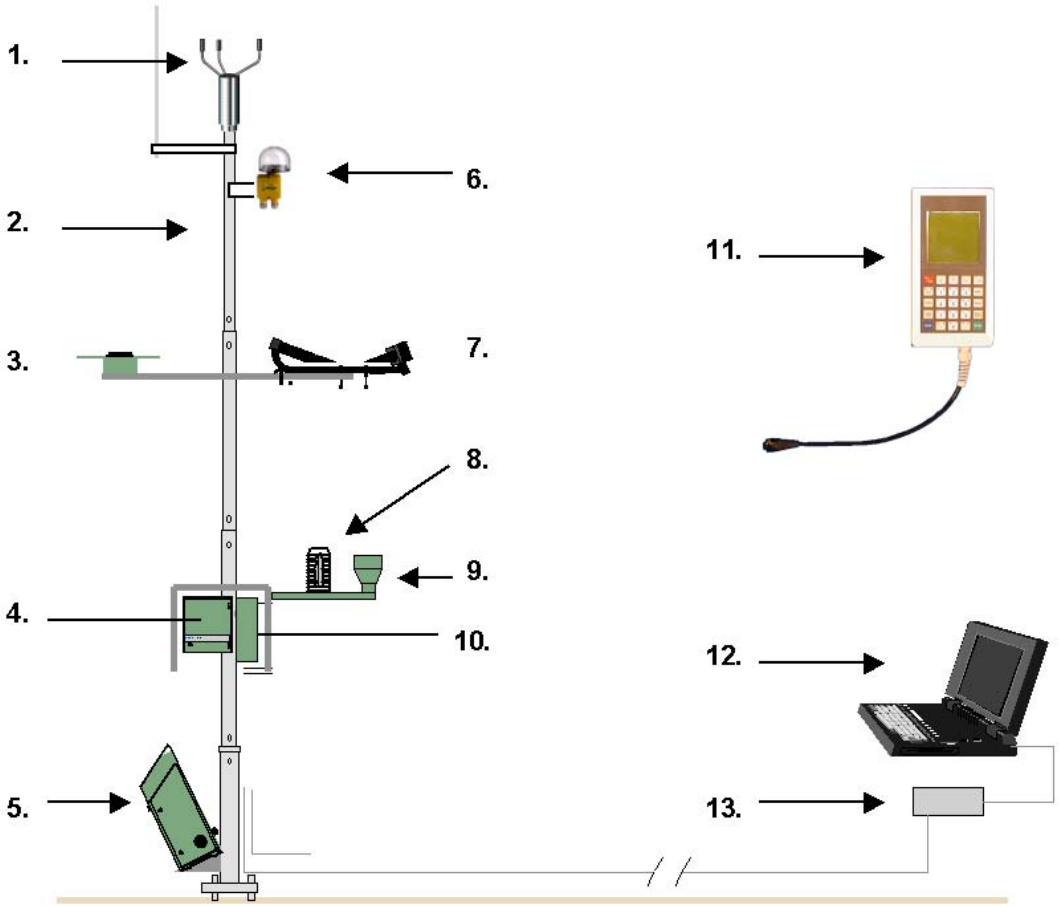

Figure 1 TACMET MAWS System

The following numbers refer to Figure 1 above:

1 = Heated Ultrasonic Wind Sensor
2 = Tiltable 6 m (20 ft) or 10 m (33 ft) mast
3 = Lightning Detector
4 = Power Supply and Connection Unit
5 = Ceilometer
6 = Obstruction Light
7 = Present Weather Detector
8 = Air Temperature and Relative Humidity Sensor
9 = Rain Gauge
10 = AWS Logger with Pressure Sensor
11 = Handheld Terminal
12 = MIDAS IV PC
13 = Communication Accessory Enclosure

MAWS Operating Software

The embedded operating software runs in the AWS logger QML102T. Access to the limited set of commands can be gained using the Handheld Terminal QMD101M or using MIDAS IV PC.

Radiation Shield

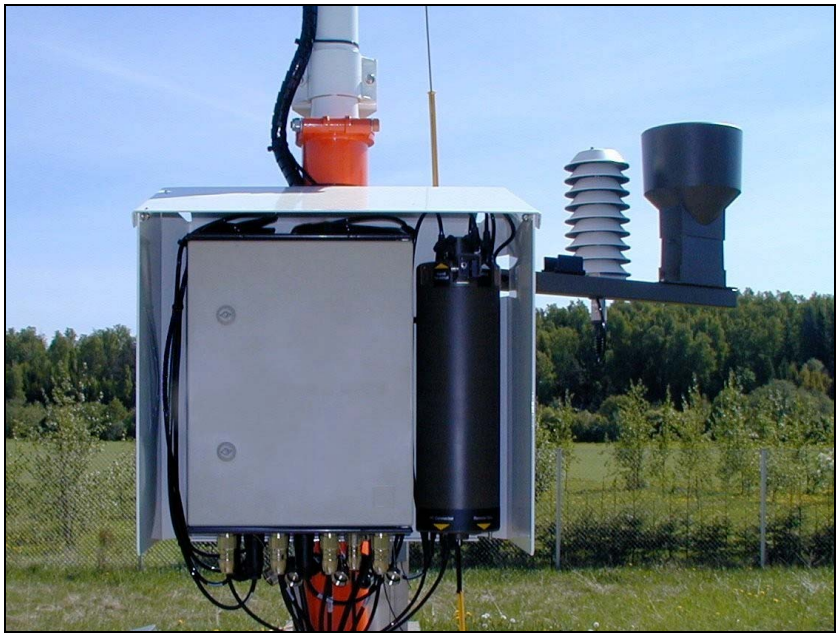

Figure 2 Radiation Shield

The radiation shield protects the QME101M logger tube, which is the same as with the mobile TACMET system, and the Power Supply and Connection Unit QMP202MP.

AWS Logger QML102T

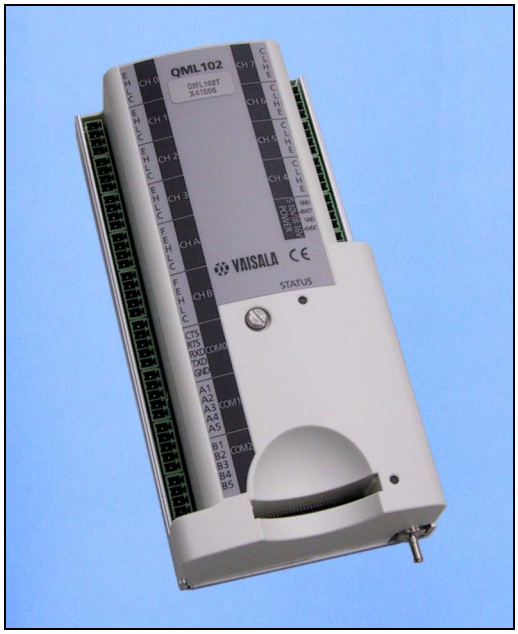

Figure 3 Logger QML102T

QML102T is a complete AWS logger designed on just one printed board. This board contains a 32 bit Motorola CPU for data processing and 10 differential (20 single ended) analog sensor inputs, that can also be used as digital inputs. Moreover, there are two frequency sensor interfaces, a 16 bit A/D converter, 1.7 Mbytes of secure Flash memory for data logging, and a charger for the internal backup battery.

The board uses the latest SMD (Surface Mount Device) technology and is conformal coated for improved protection also in high humidity. Each sensor input has a varistor (VDR) protection against induced transients. The maintenance terminal connection (RS-232, COM0) has transzorb diodes in its inputs.

In MAWS201MP the QML102T logger is located inside the logger tube QME101M and is further encased to protect the circuit board and the internal battery. The cover of this protective housing can be removed for installation of the battery and for maintaining MAWS.

Optional modules under the housing include, for example, various communication modules and a built-in pressure transducer.

Power Supply and Connection Unit QMP202MP

MAWS201MP (see Figure 2 on page 17) is a low-power system. When AC (mains) power (230 or 115 VAC) is available on the installation site, an AC (mains) power supply is used to charge the battery. QMP202MP includes the following modules: the backup battery, the battery regulator, AC (mains) power supply units, and the communication device. The unit is easily mounted under the radiation shield.

Backup Battery

QMP202MP houses a sealed and maintenance-free 12 Ah battery. The battery is charged with QBR101 Battery Regulator that is connected to the AC (mains) power supply.

Battery Regulator QBR101

Battery Regulator QBR101 is a charging and supervising instrument for 12/24 Volts lead acid and nickel-cadmium batteries. QBR101 allows input from AC (mains) power.

The maximum charging current can be set by the internal jumper settings either 0.5 A, 1.0 A, 2.0 A, or 2.5 A. QBR101 is applicable to a battery capacity of 4 to 72 Ah. Self-consumption from the battery is very low, less than 0.2 mA.

The LED lamps indicate battery regulator conditions. In order to maximize autonomy time, the LED lamps are activated only while pressing the ON button. QBR101 is a rail-mountable unit allowing for easy maintenance.

Power Supply Unit BWC15SXZ

The AC (mains) power supply unit BWC15SXZ is a switching power supply, which operates from the universal AC input of 85 to 264 VAC and 47 to 440 Hz. The output voltage is 15 VDC, which is used for powering the MAWS201MP system, and as an input to the battery regulator QBR101 for charging the backup battery. BWC15SXZ is installed inside QMP202MP on a standard DIN-rail enabling easy maintenance of the unit.

Power Supply Unit BWT36SXZ

The AC (Mains) power supply unit BWT36SXZ is a switching power supply, which operates from the universal AC input of 85 to 264 VAC and 47 to 440 Hz. The output voltage is 36 VDC, which is used for supplying heating power to Vaisala Ultrasonic Wind Sensor WS425. BWT36SXZ is installed inside QMP202MP on a standard DIN-rail enabling easy maintenance of the unit.

Power Strip QPS101

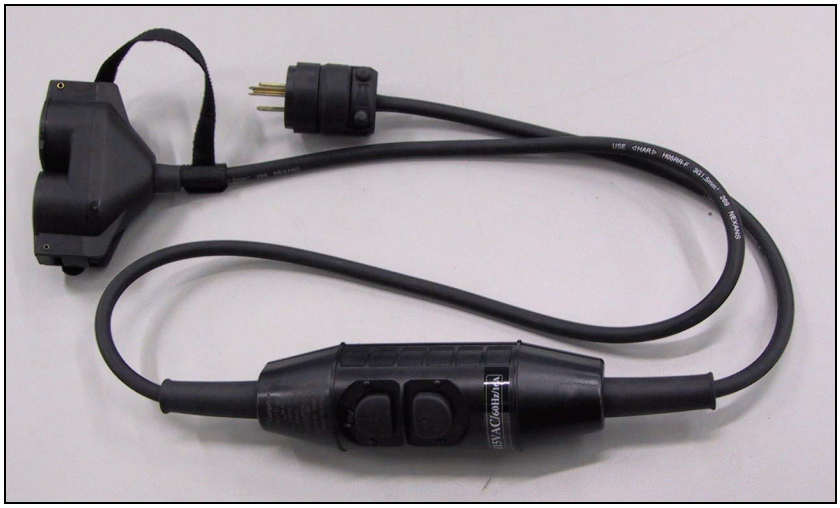

Figure 4 Power Strip QPS101

Power Strip QPS101 is a safety switch, which is used in connecting the QMP202MP to AC (mains) power outlet. QPS101 has two buttons: the test button for the circuit breaker and the current switch. The circuit breaker activates when the leakage is over 30 mA.

Transmitter WT501

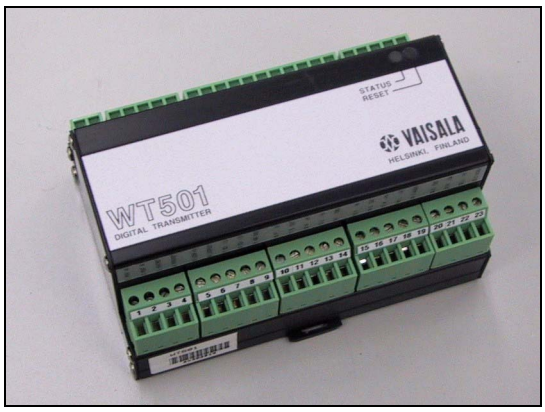

Figure 5 Transmitter WT501

The WT501 composes the digital transmitter PCB with connectors enclosed into an anodized aluminum profile with DIN-rail mounting. The unit is installed as such in an equipment enclosure designed to withstand the environmental conditions in question.

The data is provided via the onboard opto-isolated serial interface of the transmitter unit. For long distance communication in MAWS201MP, the transmitter is equipped with an isolated Modem Module DMX501.

Modem Module DMX501

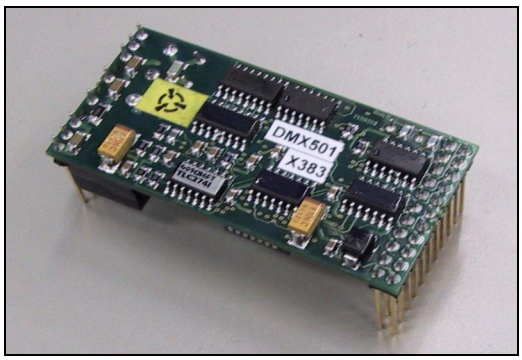

Figure 6 Modem Module DMX501

The DMX501 module is used for providing a long distance fixed-line connection between MAWS201MP and MIDAS IV PC, which has an RS-232 serial connection to a similar module installed inside the QCA101 unit.

Through this module, MAWS201MP sends reports and data or the MIDAS IV PC sends new settings to the logger. The modem module DMX501 is configured at the factory to use the communication standard V.22, 1200 bps DPSK

Ultrasonic Wind Sensor WS425

Figure 7 Ultrasonic Wind Sensor WS425

Ultrasonic Wind Sensor WS425 uses ultrasound to determine wind speed and wind direction. The sensor has no moving parts and it is resistant to corrosion and contamination The sensor has a built-in heater. The elements have a built-in thermostat to switch the heaters on when the transducer head needs it. The sensor needs 36 VDC to power the heater elements. When connected to MAWS201MP, the sensor uses the analog signal output providing wind speed and direction data.

An adapter for the Ultrasonic Wind Sensor is included in the mast delivery. It has a clamp for mast attachment and two holes for sensor attachment. See Figure 8 on page 23.

Figure 8 Installation Adapter for Ultrasonic Wind Sensors

Air Temperature and Relative Humidity Sensor QMH101M

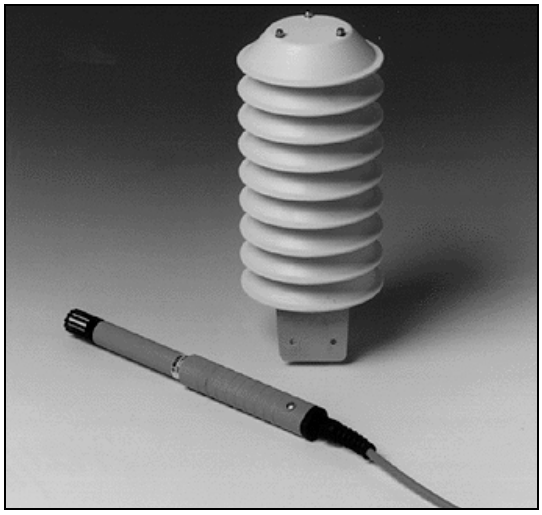

Figure 9 QMH101M with Radiation Shield

Air Temperature and Relative Humidity Sensor QMH101 is based on Vaisala's field-proven HMP45D probe and comes with a special cable and connector. For humidity measurements, the HUMICAP® sensor is highly accurate and offers excellent long-term stability in a wide range of environments. Temperature measurements are taken by an accurate Pt-100 IEC751, 1/3 Class B.

Replacement is simple; the probe head containing the electronics can be quickly removed from the probe body, while a replacement is

installed and the measurement continues. Meanwhile the other probe head can be calibrated.

The probe is installed in a naturally aspirated shield made of injection molded UV stabilized plastic. The shield has a multiplate design providing the necessary shielding from solar radiation and precipitation.

Pressure Sensor PMT16A

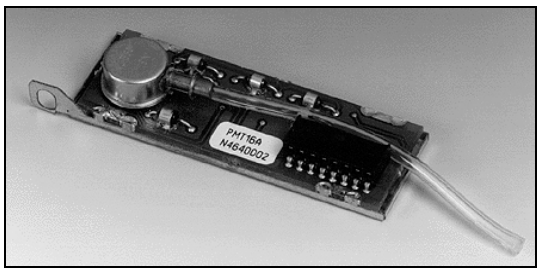

Figure 10 Pressure Sensor PMT16A

The silicon capacitive pressure sensor PMT16A has excellent accuracy, repeatability, and long-term stability over a wide range of operating temperatures. It maintains its accuracy and calibration for long periods of time, thus reducing the need for field calibrations.

The fine adjustment and calibration of the sensor at the factory are handled according to the electronic working standards, which are based on international standards.

Rain Gauge QMR101M

Figure 11 Rain Gauge QMR101M

Rain Gauge QMR101M is an economical and accurate rain gauge made of plastic, which is frostproof and highly resistant to UV-radiation. QMR101M has a self-emptying tipping spoon of 0.2 millimeters capacity. QMR101M comes with a ready-made cable and connector.

Ceilometer CT25KAM

Figure 12 Ceilometer CT25KAM

CT25KAM employs pulsed diode laser LIDAR (Light Detection and Ranging) technology for cloud detection, precipitation, and other obstructions to vision, and accurate cloud heights and vertical visibility determination.

The standard measurement range of CT25KAM extends up to 25 000 feet (7.5 km) covering most heights where dense clouds appear. The instrument is capable of reporting up to three cloud layers simultaneously. It detects the cloud base reliably in fog, rain, snow, and haze. If the cloud base is obscured, CT25KAM measures and reports vertical visibility.

Extensive internal monitoring is supported by a comprehensive set of user commands that can be given locally or remotely. Internal monitoring includes a sensor measuring the outgoing laser pulse energy, circuitry checking the receiver sensitivity, a sensor monitoring window contamination, and two sensors measuring the tilt angle. These and other internal measurements are used by the diagnostics software and the detection algorithm for maximum reliability and ease of use.

A special additional tilt sensor is provided as standard for automatically compensating uneven terrain. Installation is made easy and fast when no exact leveling is required. The cloud coverage algorithm in the CT25KAM is a further development of the algorithm specified by FAA. Cloud coverage (amount) is reported in 0 to 8 octas, according to WMO regulations.

Present Weather Detector PWD11A

Figure 13 Present Weather Detector PWD11A

Present Weather Detector PWD11A is an intelligent multivariable sensor for automatic weather observing systems. The sensor combines the functions of a forward scatter visibility meter and a present

weather sensor. In addition, PWD11A can measure the intensity and amount of both liquid and solid precipitation.

The versatility of PWD11A is achieved with a unique operating principle. PWD11A measures an estimate of the precipitation water content with a capacitive device and combines this information with optical scatter and temperature measurements. These three independent measurements together sufficiently provide data for an accurate evaluation of the prevailing visibility and weather type.

PWD11A is calibrated with reference to a highly accurate transmissometer. An extensive self-diagnostic procedure continuously monitors the sensor status. Dirt and foreign particles on the lens are detected automatically, minimizing the risk of false high values. A special calibration kit is provided as an option for conducting field calibration under practically all weather conditions.

PWD11A is small and lightweight, thus being easy to install on the sensor cross arm. In addition to the standard sensor operation, the MAWS software adds extra features such as reporting of coded weather type identifications as plain text in the output reports.

Lightning Detector SA20M

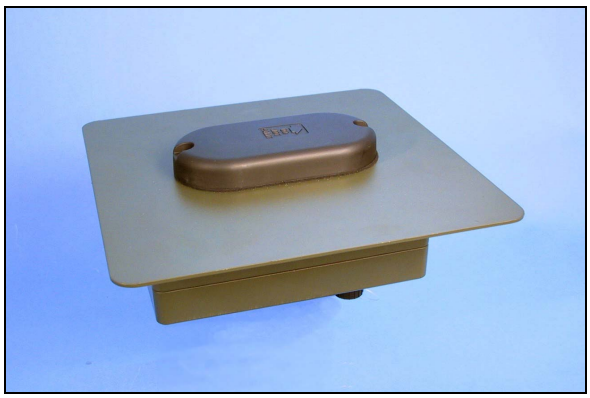

Figure 14 Lightning Detector SA20M

Lightning Detector SA20M detects the position of lightning activity and reports lightning and thunderstorm positions with respect to the location of SA20M. A stand-alone thunderstorm sensor is self-contained and weather-tight.

The SA20M sensor detects cloud-to-cloud, cloud-to-air and cloud-to-ground lightning activity to a range of 90 km (50 nmi.). The ability to detect inter-cloud activity allows SA20M to report lightning during

the building stages of a thunderstorm, before sufficient charge build-up has occurred that would generate a ground strike. Consequently, SA20M provides early warnings of potentially fatal single-event ground strikes.

Tiltable Pole Mast

Figure 15 Tiltable Pole Mast DKP210AV-T

DKP206AV-T and DKP210AV-T tiltable pole masts can be easily operated by one person when installing and maintaining the devices installed on the mast. Also special attention has been paid to easiness and quickness of the mast installation. The height of DKP206AV-T is 6 m (20 ft) and DKP210AV-T is 10 m (33 ft).

Foundation Set

The foundation set includes all the necessary installation accessories both for a new and an existing concrete pad.

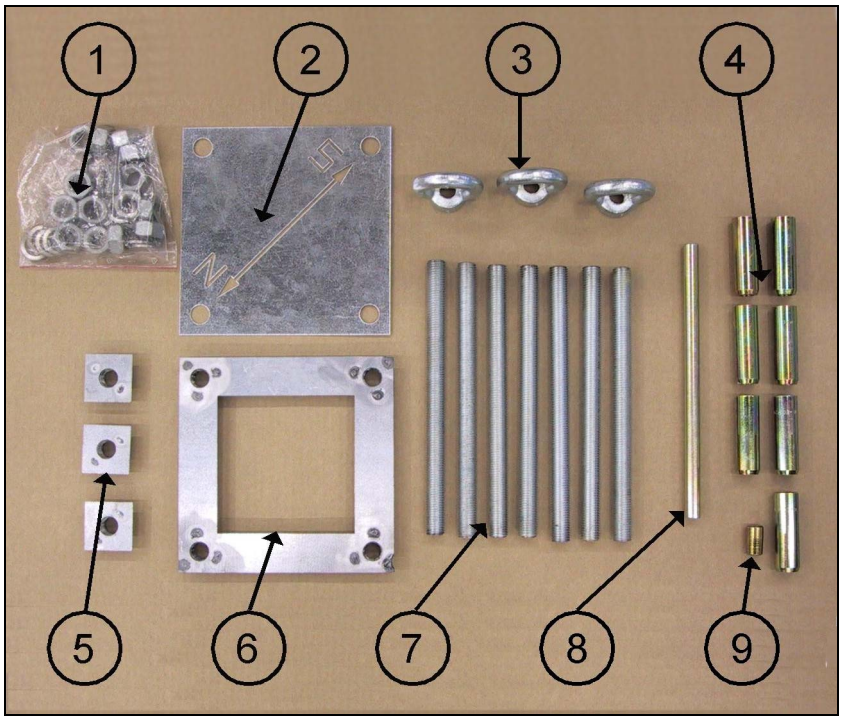

Figure 16 Foundation Set for DKP206AV

The following numbers refer to Figure 16 above:

1 = Nuts and washers for foundation bolts
2 = Orientation plate for the mast base
3 = The eye nuts for guy wires
4 = Wedge bolts for existing concrete block
5 = Plates with the nut for guy wire blocks
6 = Square plate for the mast base
7 = Foundation bolts
8 = Bar for the wedge bolts
9 = Key piece for the wedge bolts

Guy Wires

The DKP206AV-T mast is delivered with one set of guy wires, whereas DKP210AV-T is delivered with two sets. Figure 17 below shows the contents of one set of guy wires and the accessories. The top fastener of the guy wires is mounted to the uppermost tube of the mast during installation.

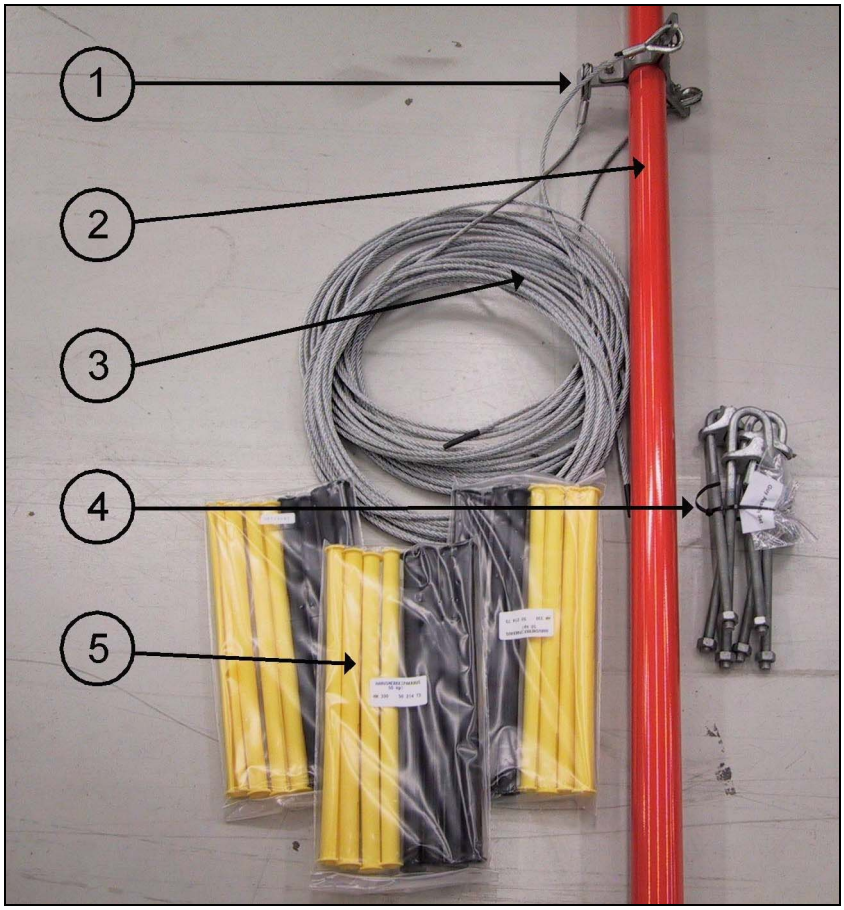

Figure 17 Guy Wires Set

The following numbers refer to Figure 17 above.

1 = Top fastener
2 = Upper mast tube
3 = Guy wires
4 = Installation accessories
5 = Cable shrouds

Lightning Rod

The mast is delivered with a passive lightning rod made from copper. The lightning rod holders are made of non-conductive material to protect the mast devices from overvoltage when lightning occurs. Refer to Figure 18 below. An active type of lightning rod is available as an option for areas where heavy lightning activity occurs frequently.

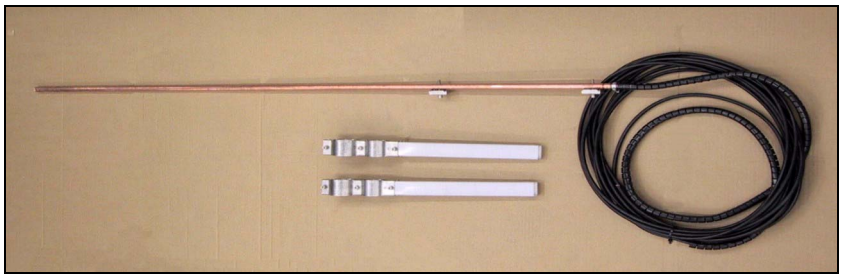

Figure 18 Passive Lightning Rod and the Holders

Winch

The winch is easily installed to the pedestal tube. After erecting the mast, the winch should be removed from the pedestal tube and stored in a dry and warm place.

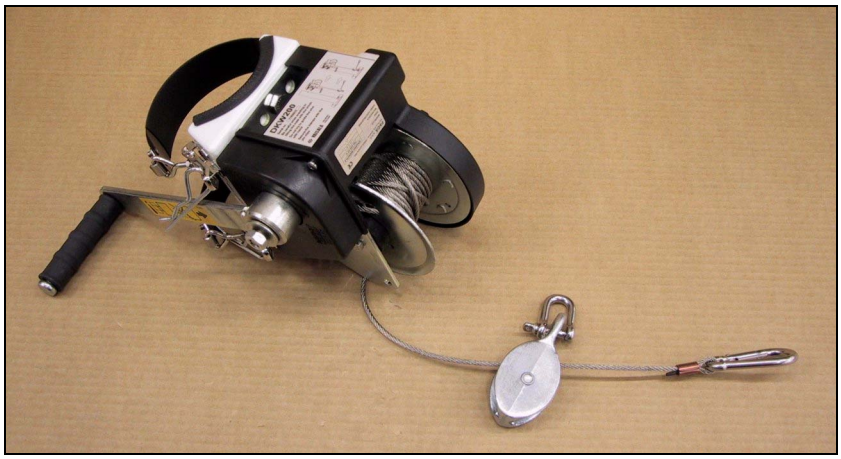

Figure 19 Winch

Obstruction Light

An obstruction light is included in the mast delivery. Obelux Obstruction Light is a very low power obstruction light utilizing LED technology with a typical intensity of 17 cd. The obstruction light is supplied with 12 VDC nominal supply voltage. The stabilized output of the light makes it possible that the variations of the supply voltage do not affect to the light output.

Figure 20 Obstruction Light with the Power Cable

Obelux Obstruction Light meets the specifications defined by ICAO. The obstruction light is provided with a mounting set for mast installation. The cabling and installation principles are similar to those of conventional obstacle lights, the only exception being the correct polarity required by the DC feed. Also, the power supply cable is included in the delivery by default.

Workstation with MIDAS IV Software

The workstation software MIDAS IV is installed onto a laptop PC. The MIDAS IV software operates in the Microsoft® Windows 2000® operating system, providing multi-tasking operation and connectivity. The workstation displays numerical and graphical data, codes METAR/SPECI aviation weather reports, as well as archives and transmits data for further processing. The Windows 2000® environment is user-friendly and provides great flexibility. MIDAS IV uses the standard Windows® user interface and features, and is therefore straightforward and easy to learn.

The workstation software facilitates editing METAR/SPECI reports by easy-to-use templates. Aviation special weather reports (SPECI) are generated automatically whenever selected criteria are met, or at any time initiated by the operator. Report transmission can also be fully automated, if necessary.

In addition, the software provides real-time graphical data display in multiple windows. Stored data can be viewed in ASCII format. The operator can monitor system performance and sensor alarms with Event Monitor.

Data is archived for 30 days on hard disk and sent to other systems via serial port or as an FTP transfer via LAN.

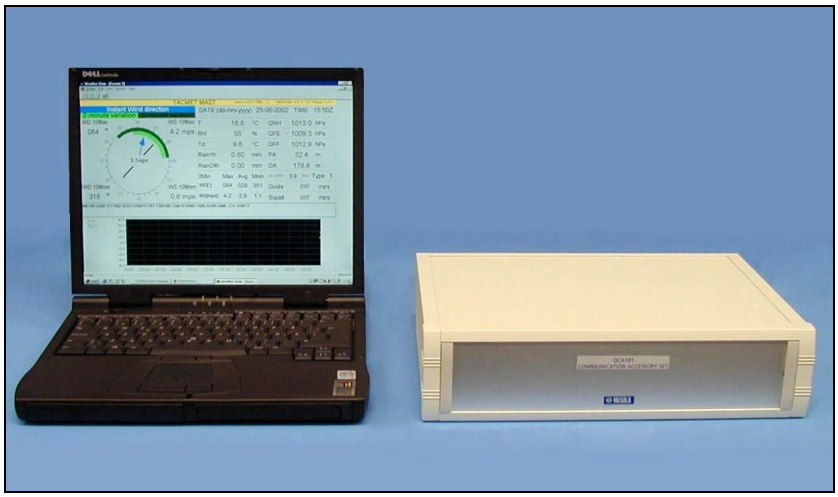

Figure 21 MIDAS IV Workstation and QCA101

Communication Accessory Enclosure QCA101

Communication Accessory Enclosure QCA101 houses Transmitter WT501 equipped with Modem Module DMX501. Additionally, AC (mains) power supply, lightning protection device, and surge arresters are located in the enclosure. In Figure 21 on page 33 the QCA101 enclosure is shown beside the MIDAS IV PC.

The maximum communication range with Modem Module DMX501 is up to 20 km (12 mi.) with a 22 AWG standard cable.

Handheld Terminal QMD101M

Figure 22 QMD101M Handheld Terminal

QMD101M is a lightweight, rugged and easy-to-read handheld display device for viewing measured and calculated parameters and systems alarms, as well as for setting station-specific parameters.

Radio Modem

Figure 23 TM32 Radio Modem

Radio modems provide wireless data communication between MAWS201MP and MIDAS IV PC.

TM32 Radio modem features a watertight design for operation in unprotected environments common in field applications. TM32 features a fully synthesized multi-channel radio that allows operation on all frequencies in the supported VHF or UHF bands.

VHF Antennas

The VHF antenna can be installed on the tripod (see Figure 24 below) or on the pole mast (see Figure 25 below). The frequency range is from 150 to 174 MHz.

Figure 24 VHF Antenna on the Tripod

Figure 25 VHF Antenna on the Mast

UHF Antennas

The UHF antenna can be installed on the tripod (see Figure 26 below) or on the pole mast (see Figure 27 below). The frequency range is from 410 to 470 MHz.

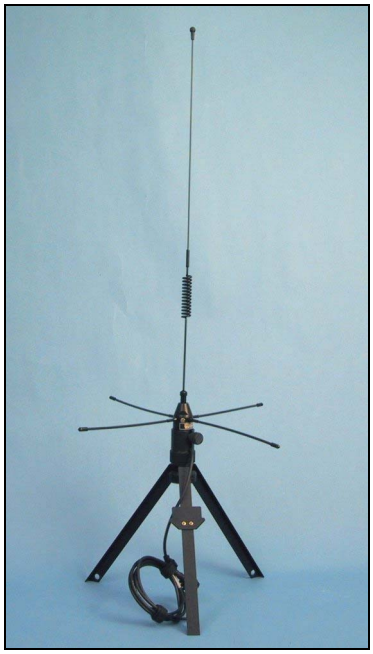

Figure 26 UHF Antenna on the Tripod

Figure 27 UHF Antenna on the Mast

Mains Power Supply Module QMP211

The AC (mains) power supply module QMP211 is a switching power supply, which operates from the universal AC input of 100 to 240 VAC and 50/60 Hz. The output voltage is 12 VDC (2500 mA), which is used for powering the radio modem when it is connected to the MIDAS IV PC for configuring.

Figure 28 Mains Power Supply Module QMP211

Product Nomenclature

Table 1 TACMET MAWS201MP Nomenclature

Code	Common Name
QML102T	Logger
PMT16A	Pressure sensor
QME101M	Logger tube
QMA102M	Sensor arm and radiation shield
WS425	Heated wind direction and speed sensor
QMH101M	Air temperature and relative humidity sensor
QMR101M	Rain gauge
DKP206AV-T	Tiltable pole mast and accessories (6 m, 20 ft)
DKP210AV-T	Tiltable pole mast and accessories (10 m, 30 ft)
DKW200	Winch for mast
QMD101M	Handheld terminal
TM32	Radio modem
QMX102SET-2	VHF Antenna Set (150 ... 174 MHz)
QMX101MSET-1	UHF Antenna Set (410 ... 430 MHz)
QMX101MSET-2	UHF Antenna Set (430 ... 450 MHz)
QMX101MSET-3	UHF Antenna Set (450 ... 470 MHz)
QMP211	Mains power supply for radio modem
QPS101	Outdoor power strip
Laptop PC	MIDAS IV PC
MIDAS IV	NT software for the MIDAS IV PC
CT25KAM	Ceilometer
PWD11A	Present weather detector
SA20M	Lightning detector
OBL10-12	Obstruction light
QMP202MP	Power supply and connection unit
QCA101	Communication accessory enclosure for PC end
WT501+DMX501	Communication module

Table 2 Cables Provided

Code	Common Name
ZZ45202	PC/Handheld connection cable with DC connector, 5 m (15 ft)
ZZ212024	WS425 Data/power cable for DKP206AV-T
ZZ212915	WS425 Data/power cable for DKP210AV-T
ZZ45214	AC cable, 5 m (15 ft)
CT45300	AC supply cable for CT25KAM
CT45298	DC/data cable for CT25KAM
ZZ45215	SA20M connection cable
ZZ45123	Data cable from QMP202MP to QME101M
ZZ212026	Data cable from QME101M to QMP202MP
ZZ212025	DC power cable between QMP202MP and QME101M
ZZ45114	Landline cable (3 pcs)
212019	Grounding cable
ZZ213068SPEC	Communication cable (length varies)
ZZ212027	Cable from QCA101 to TacLap PC

CHAPTER 3

INSTALLATION OF THE MAST

This chapter provides instructions for preparing the installation and selecting the site for the station. It also contains detailed information on installing the tiltable pole mast.

Siting Criteria

Finding a suitable site for the MAWS201MP weather station is important for getting representative ambient measurements. When locating the weather station, consider the items presented in the following sections. The descriptions are not comprehensive, for further information refer to local and WMO recommendations.

Also note the tilting direction of the mast. When installed in the northern hemisphere, the mast tilts to west. There should be a clear area up to 9 m on the west side of the mast. The area should be free of obstacles preventing the mast from being erected and tilted.

Soil Evaluation

Always, evaluate the soil to determine the appropriate type of the foundation required. When designing the foundation, the local construction companies must be consulted to find out about the soil and frost conditions in your area. When the soil is frost-susceptible, make sure to always use the proper insulation.

CAUTION	For mast base installation, the soil bearing capacity has to exceed 45 kPa (940 pounds-force/sq. foot).

Wind Measurement

Allow sufficient clearance for the wind sensors, that is, the station should not be located next to a building or any other object that might affect the airflow. Refer to Figure 29 below and Figure 30 on page 43 that provide general guidelines for the mast location.

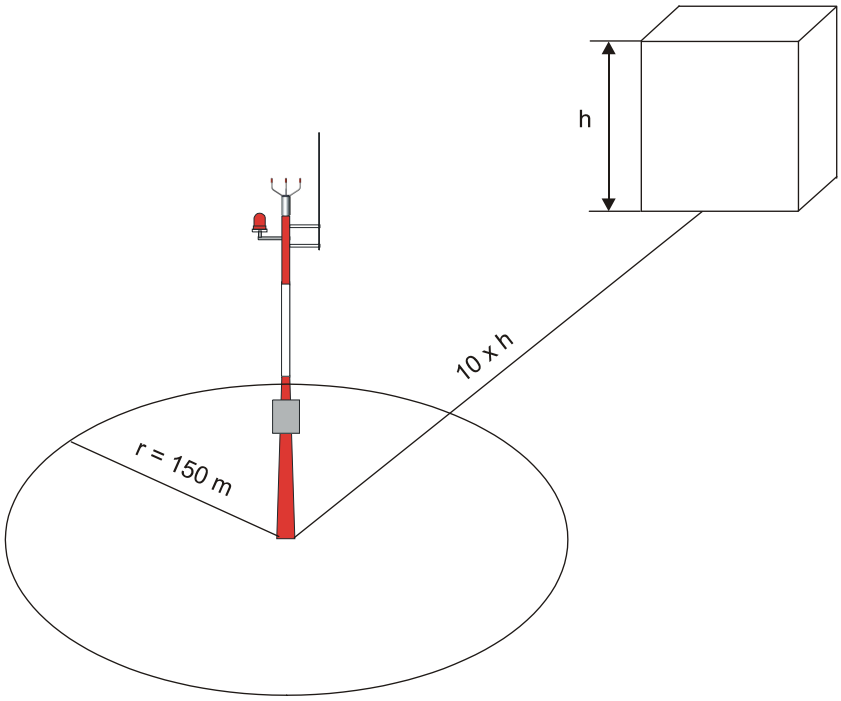

Figure 29 Recommended Mast Location in Open Area

In general, there should be at least 150 m (≈ 500 ft.) open area to all directions from the mast. The minimum distance between the mast and obstacles is ten times the height of an obstacle. Refer to Figure 29 above.

The recommended minimum length (h in Figure 30 on page 43) for the mast that is installed on top of a building is 1.5 times the height of the building (H). When the diagonal (W) is less than the height (H), the minimum length of the mast is 1.5 times W.

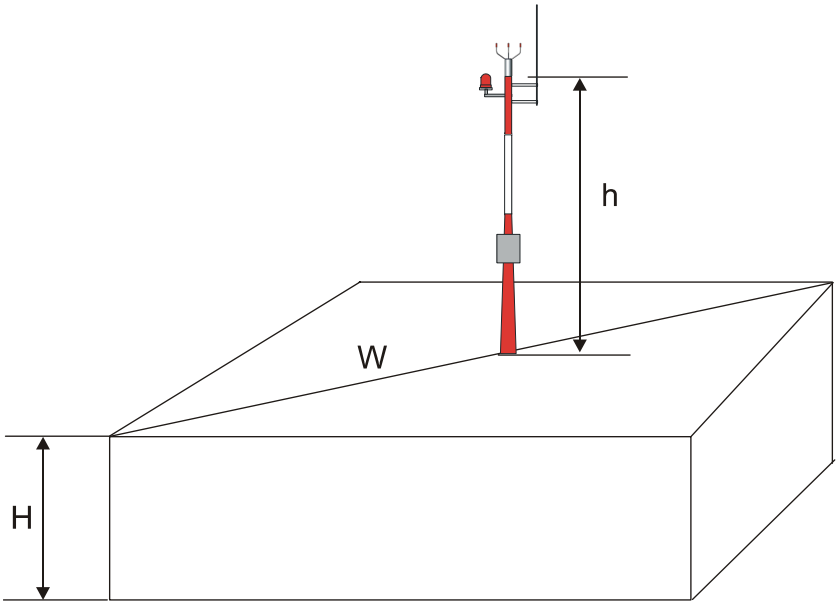

Figure 30 Recommended Mast Length on Top of a Building

Air Temperature and Relative Humidity

NOTE	The radiation shield is important in protecting the sensor from direct sunlight and should always be used.

For mast installations, the height of the sensor should be set between 1.5 to 2 meters. Avoid the following installation sites to ensure correct measurements: shaded areas, steep slopes, heat sources, swamps, high vegetation, and places that might hold water after rains.

Precipitation

QMR101M Rain Gauge is installed on the same sensor arm with the air temperature and relative humidity probe. In general, objects should not be closer to the gauge than a distance twice their height above the gauge opening.

The orifice of the gauge must be on a horizontal plane, open to the sky, and above the level of in-splashing and snow accumulation. In general, objects should not be closer to the gauge than a distance twice their height above the gauge orifice.

In areas of homogeneous dense vegetation, the height of the vegetation should be kept below the gauge orifice level by regular mowing. Sites on a slope or on the roof of a building should be avoided. Also hard flat surfaces such as concrete should be avoided to prevent excessive in-splashing.

Lightning Detection

SA20M Lightning Detector is installed on the sensor arm of the mast. The main siting consideration for the SA20M sensor is interference from local obstructions. Any conducting object, except the pole mast, that presents a profile of approximately 30 degrees, or more, above the horizon of the antenna ground plane is an obstruction. For a metal building (very wide, solid metallic wall) that is 9 m (30 feet) taller than the mounted height of SA20M, the sensor should be placed at least 18 m (60 feet) away. Refer to Figure 31 below.

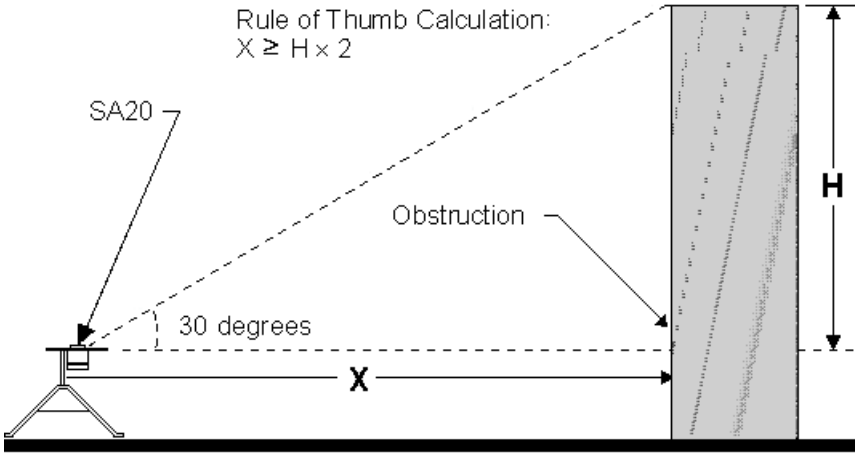

Figure 31 SA20M Vertical Obstruction (Side View)

Horizontal obstructions do not greatly effect the detection efficiency of SA20M. However, it is desirable to have no obstructions to the sensor. The horizontal angle obstructed by an object should not be greater than 5 degrees; larger angles than this will affect accurate reporting of strike bearing in the direction of the object as shown in Figure 32 on page 45. The size of the obstruction dictates the degree of the inaccuracy.

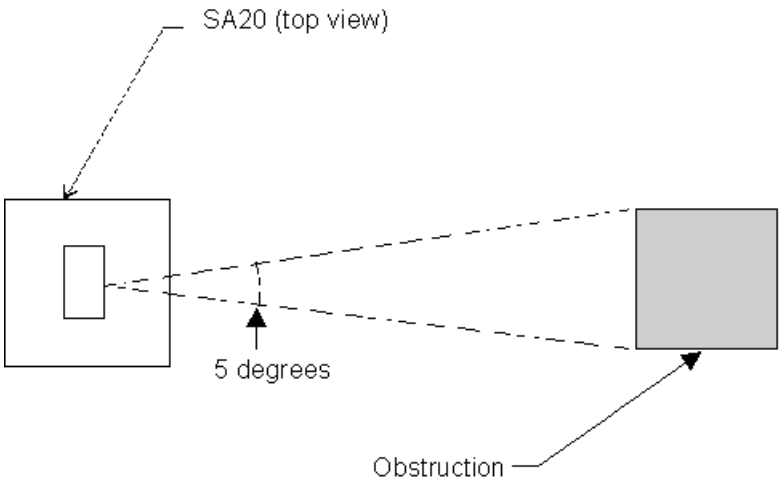

Figure 32 SA20M Horizontal Obstruction (Top View)

Siting of the SA20M sensor also depends on the location of buried electrical cables and electrical transformers. Site the SA20M sensor away from emitters of electromagnetic interference, such as buried electrical cables, and electrical transformers. SA20M will send a message to the handheld terminal if the siting has been unsuccessful.

NOTE	SA20M can not be installed inside a closed-in structure. It must always be installed outdoors facing magnetic north.

Present Weather Detection

Present Weather Detector PWD11A is installed on the sensor arm of the mast. Avoid setting the system up near high brush or grass, because foreign objects in the sample volume may cause sudden changes in the scatter signal.

For the location of PWD11A the main requirements are:

1. PWD11A should be sited in such a way that the measurements will be representative of the surrounding weather conditions. PWD11A should ideally be located in such a way that the site has a minimum clearance of 100 m from all large buildings and other constructions that generate heat and/or obstruct precipitation droplets. The shade of trees should also be avoided as trees may cause changes in the microclimate.

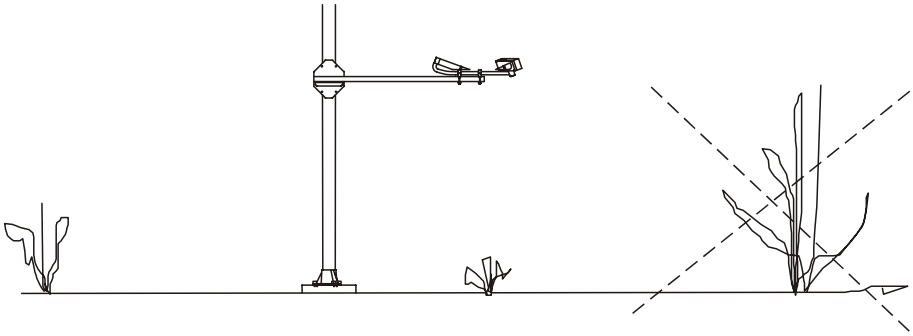

Figure 33 Recommended Location of the PWD11A

2. The site should be free of obstacles and reflective surfaces disturbing the optical measurement as well as obvious sources of contamination. It is recommended that there are no obstacles in the line-of-sight of the transmitter and receiver units, see Figure 33 above. If the transmitter beam is reflected from obstacles back to the receiver unit the sensor will indicate too low MOR values, because the reflected signal can not be distinguished from real scatter signal. Reflections can be detected by rotating the sensor cross arm. Any reflections will change depending on the cross arm orientation and the visibility reading will change accordingly.
3. The receiver and transmitter optics should not point towards powerful light sources. It is recommended that the receiver will point north in the northern hemisphere, and south in the southern hemisphere. The receiver circuit may become saturated in bright light, in which case the built-in diagnostics will indicate a warning. Bright daylight will also increase the noise level in the receiver.
4. The transmitter and receiver should face away from any obvious source of contamination such as spray from passing vehicles. Dirty lenses will cause the sensor to report too high visibility values. The sensor automatically detects excessive contamination.
5. Although PWD11A is designed to withstand harsh weather conditions, there are locations where the environment places further demands on installation. Arctic and comparable environments may cause high snow and ice accumulation requiring additional heating. In this case, consult Vaisala or its authorized representative.

Cloud Detection

Align the ceilometer with the optical window pointing away from the sun, that is, north in the northern hemisphere (south in the southern hemisphere), to keep excess sunlight from out of the sensor. When siting the ceilometer make sure that the optical window can be oriented so that it has clear view of the sky. The lens should not be shadowed by any obstacles.

The ceilometer does not have to be mounted vertically straight, because it is equipped with two tilt-angle sensors.

Site Preparation

Power Supply and Communication Lines

Before assembling the mast the power supply and communication lines must be available. The primary AC (mains) power service must comply with the National Electrical Code (NEC) or equivalent specifications for grounding the primary power service entrance. The mains must be continuous and without spikes and blackouts. If the AC (mains) voltage is fluctuating more than the given tolerance, AC (mains) voltage stabilizers are recommended.

The following applies to all field cabling:

- Use armored field cables.
- Cables must be suitable for underground use.
- Check the cable core diameter according to maximum allowable drop.
- Route the cables through conduits to the equipment.
- Check cable conduit diameters or use additional termination boxes.
- Ground the cable shield at both ends.
- Use spike and overvoltage protection devices at both ends of field cables.

Always make a detailed cabling and wiring plan. Data transmission lines from the outdoor sites to indoor devices have to be prepared

carefully. Also the power supply for the equipment used needs to be planned carefully.

It is recommended to use a conduit to protect the cables that connect the indoor components to the outdoor components from damage and moisture. Note also, that traffic, standing water, and the twist and stress caused by the connectors can damage the cables.

Required Tools

For installing the mast, you need a set of Allen keys, two adjustable wrenches, a water level, and a big hammer.

For details on the tools that are needed in the installation procedure of the weather station components, refer to section Preparing Installation on page 87.

Unpacking Instructions for the Mast

Inspection of the Delivery

Check the shipping boxes for possible damage. Check that there are no loose parts or connectors before installing the mechanics of the equipment and cabling them. If there has been any damage, contact Vaisala immediately.

Also refer to the unpacking instructions of the weather station components in section Unpacking Instructions on page 87.

Contents of the Delivery

The mast and the accessories are packed into cartons. The contents of the cartons may vary depending on the selected options. Check the delivery contents against the packing list provided in a plastic folder on or inside the carton. Refer to Figure 34 on page 49 and Figure 35 on page 50 to identify the items.

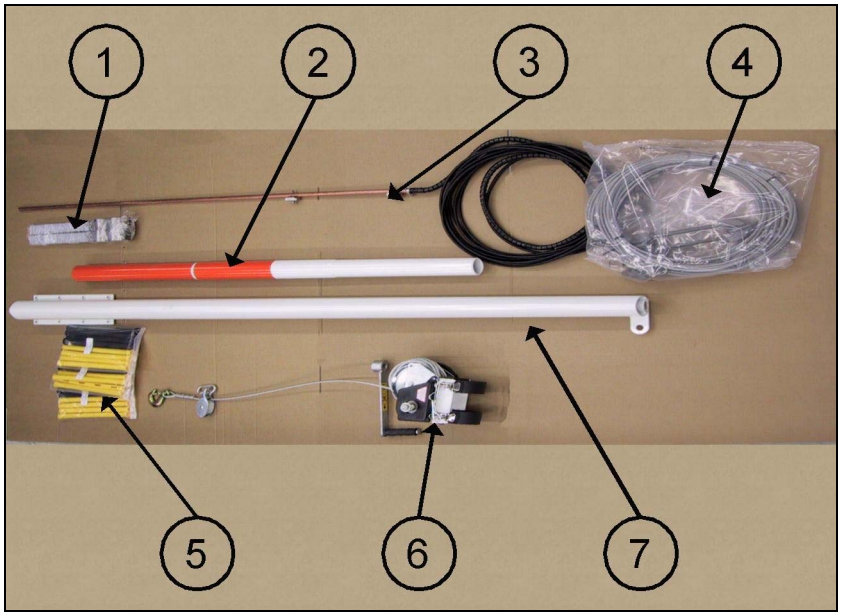

Figure 34 Contents of the Mast Delivery (Part 1)

The following numbers refer to Figure 34 above.

1 = Holders of the lightning rod (2 pcs)
2 = Upper mast tube, ∅ 60 mm
3 = Lightning rod with the cable
4 = Guy wires
5 = Cable shrouds for the guy wires (yel/blk, 3 sets)
6 = Winch
7 = Lifting rod, ∅ 60 mm

NOTE	Figure 34 above and Figure 35 on page 50 only provide examples of the contents. The contents may vary depending on the model of the mast and on the selected options.

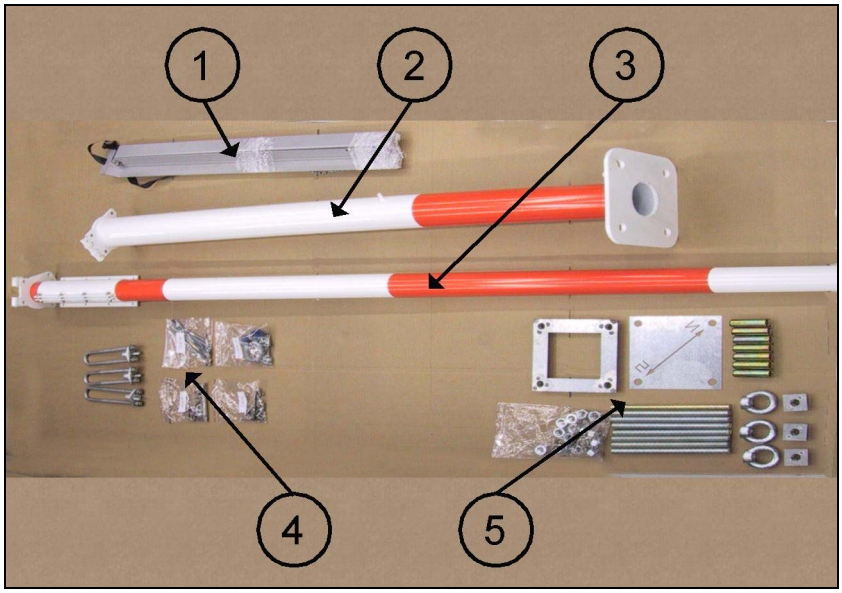

Figure 35 Contents of the Mast Delivery (Part 2)

The following numbers refer to Figure 35 above:

1 = Tilting support
2 = Pedestal tube, ∅ 100 mm
3 = Lower mast tube, ∅ 75 mm
4 = Assembly set:
- Guy wire fasteners (3 pcs)
- Guy assembly set (1 set)
- Hinge set (1 set)
- Lifting rod assembly set (1 set)
- Lightning rod assembly set (1 set)

5 = Foundation set:
- Foundation bolts, M20 (7pcs)
- Wedge bolts, M20 (7 pcs)
- Tool for wedge bolts (1 pc)
- Eye nuts for guy wires (3 pcs)
- Spring washers, M20 (10 pcs)
- Washers, M20 (10 pcs)
- Nuts, M20 (14 pcs)
- Nuts with plate, M20 (3 pcsc)
- Square plate with 4 nuts (1 pc)
- Orientation plate (1 pc)

Foundation

Soil and Frost Conditions

When designing the foundation, a local construction company must be consulted to find out about the soil and frost conditions in your area. When the soil is frost-susceptible, make sure to always use the proper insulation.

Orientation of the Mast

Refer to Figure 36 on page 52 and Figure 37 on page 53 for the orientation of the mast. The concrete pads for guy wires have to be placed so that the pole mast can be tilted west (east in the southern hemisphere) by releasing only the guy wire 1.

To ease the orientation of the mast, the two-headed arrow is cut on the orientation plate. "N" should face north and "S" should face south to ensure the aiming of the weather station devices to the correct position.

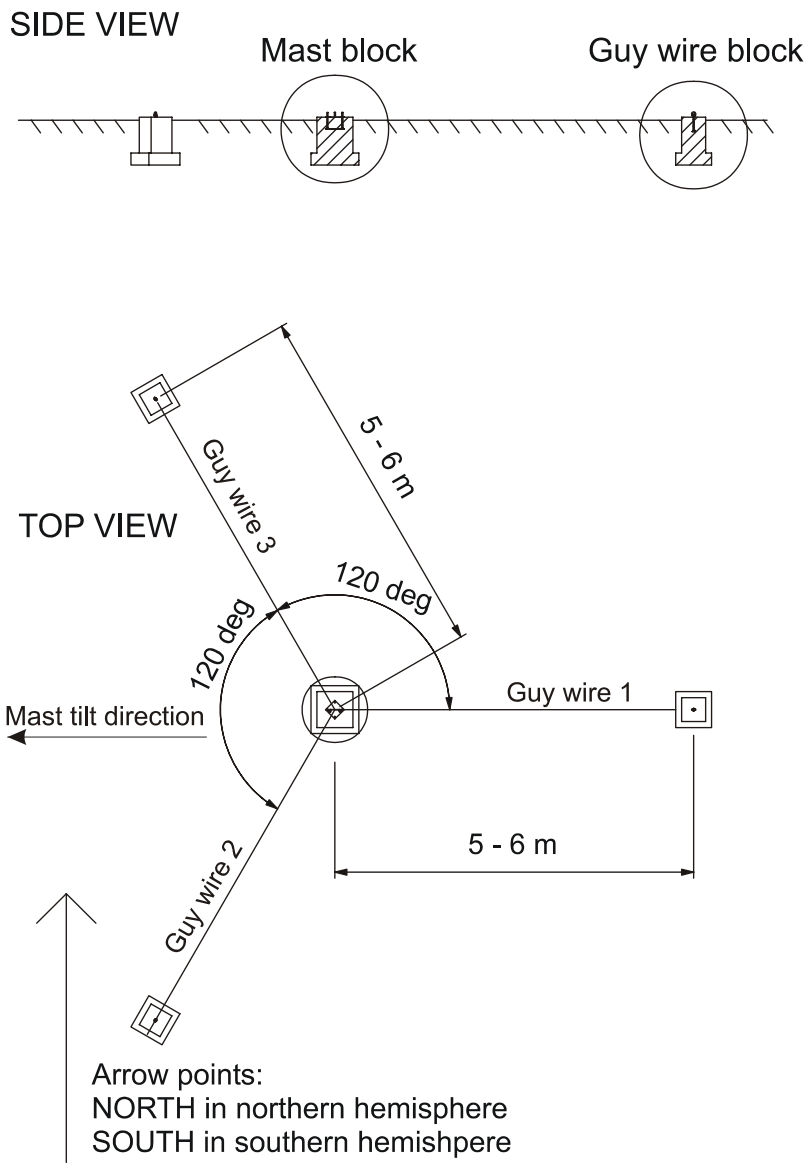

Figure 36 DKP210AV-T Mast Orientation

NOTE	The transformation for the dimensions in Figure 36 above: 5 m ≈ 16.4 ft. 6 m ≈ 19.7 ft.

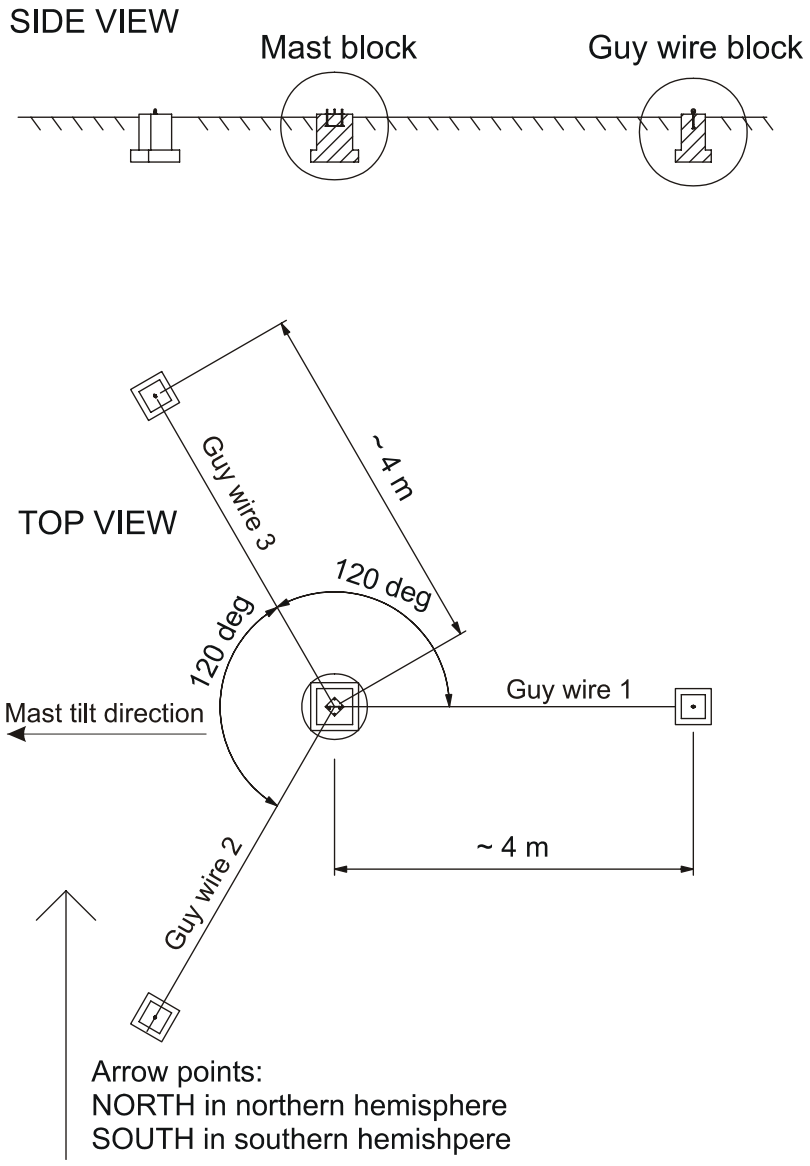

Figure 37 DKP206AV-T Mast Orientation

NOTE	The transformation for the dimensions in Figure 37 above: 4 m ≈ 13.1 ft.

Concrete Foundation Types

The tiltable pole mast can be mounted on a new or an existing concrete pad. The pole mast is fixed to the concrete pad with foundation bolts.

When preparing a new concrete pad, fasten the foundation bolt assembly simultaneously with the concrete pour. If there is an existing concrete foundation, you have to drill the holes for the foundation bolts. In both cases, use the delivered orientation plate for correct placing of the foundation bolts. For the protection of the cables, it is recommended to install a cable conduit, for example, one with an inner diameter of 70 mm (2.76 in.). See Figure 38 below.

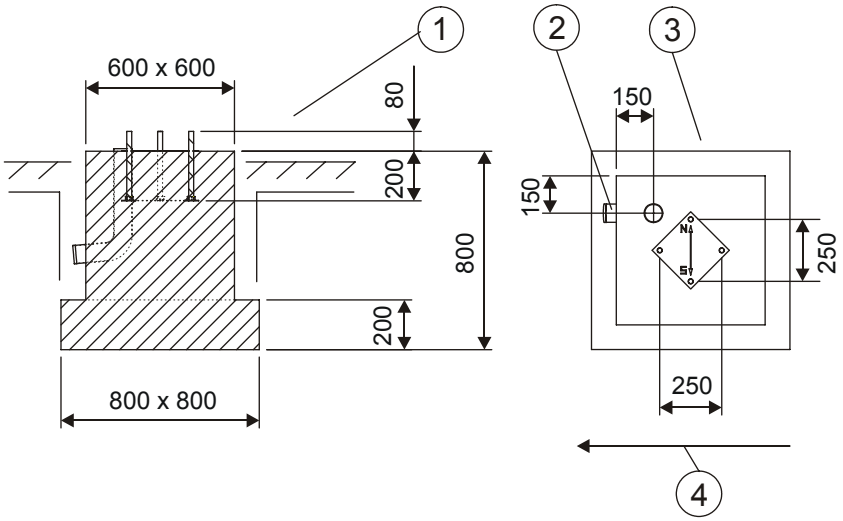

Figure 38 Concrete Pad for the Mast and Orientation Plate (Dimensions in mm)

The following numbers refer to Figure 38 above:

1 = Side view of the main mast block
2 = Cable conduit
3 = Top view of the main mast block
4 = Tilting direction of the mast

NOTE

The transformation for the dimensions in Figure 38 on page 54:
80 mm ≈ 3.15 in.
150 mm ≈ 5.91 in.
200 mm ≈ 7.87 in.
250 mm ≈ 9.84 in.
600 mm ≈ 23.62 in.
800 mm ≈ 31.50 in.

Concrete pad dimensions for the guy wires are presented in Figure 39 below.

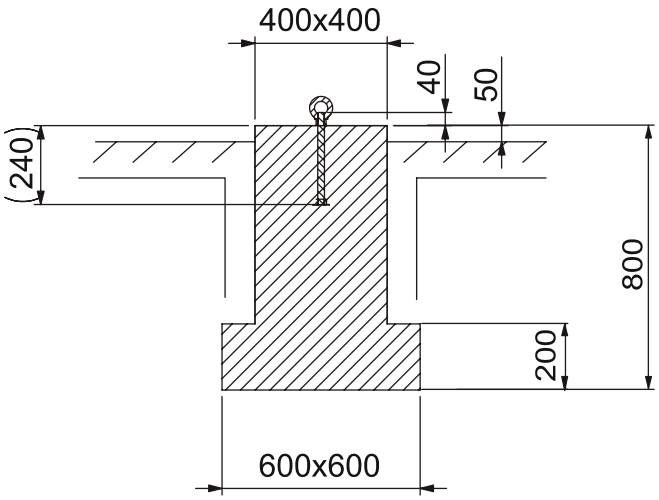

Figure 39 Concrete Pad for Guy Wires (Dimensions in mm)

NOTE

The transformation for the dimensions in Figure 39 above.
40 mm ≈ 1.57 in.
50 mm ≈ 1.97 in.
240 mm ≈ 9.45 in.
400 mm ≈ 15.75 in.
600 mm ≈ 23.62 in.
800 mm ≈ 31.50 in.

Making a New Concrete Pad

NOTE

The transformation for the dimensions in this section:
10 mm ≈ 0.39 in.
12 mm ≈ 0.47 in.
40 mm ≈ 1.57 in.
50 mm ≈ 1.97 in.
70 mm ≈ 2.76 in.
150 mm ≈ 5.91 in.
300 mm ≈ 11.81 in.
400 mm ≈ 15.75 in.
600 mm ≈ 23.62 in.

1. Make a cast mould with steel reinforcements in accordance with the design shown in Figure 40 below. Use the 12-mm deformed steel. The distance between the horizontal layers should be approximately 200 mm. Note that you can make the pads for the guy wires similarly, but the reinforcement horizontal bar length should be 300 mm instead of 400 mm as presented in Figure 40 below.

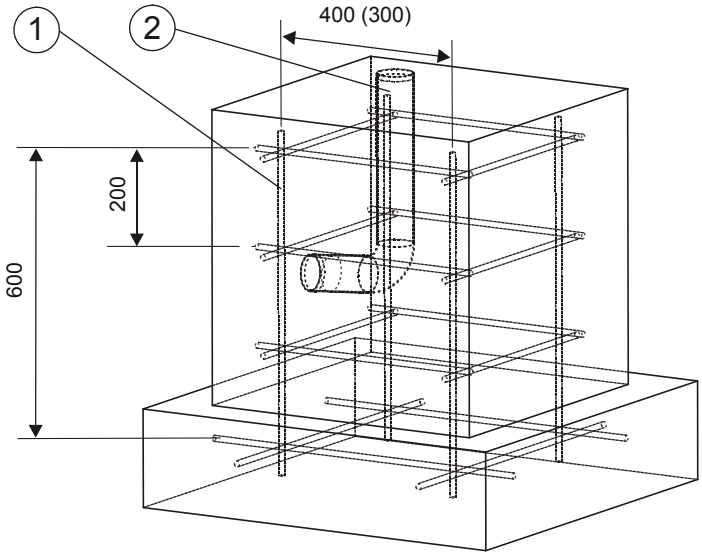

Figure 40 Reinforcement for the Concrete Pads

The following numbers refer to Figure 40 above:

1 = 12 mm (0.47 in) deformed steel
2 = Cable conduit

2. When applicable, place a cable conduit into the casting mould prior to casting. The recommended inner diameter of a single conduit is 70 mm (2.76 inches).
3. Place the steel reinforcement into the casting mould.
4. Screw the foundation bolts (number 1 in Figure 41 below) to the nuts (6), which are fixed to the square metal plate (3).
5. Fix the orientation plate (2) to the upper ends of the foundation bolts (1) with eight nuts (4 and 5), see Figure 41 below. The top of the bolt should be approximately 80 mm above the orientation plate, refer to Figure 38 on page 54.

CAUTION Protect the threads of the bolts above the orientation plate, for example, by taping them.

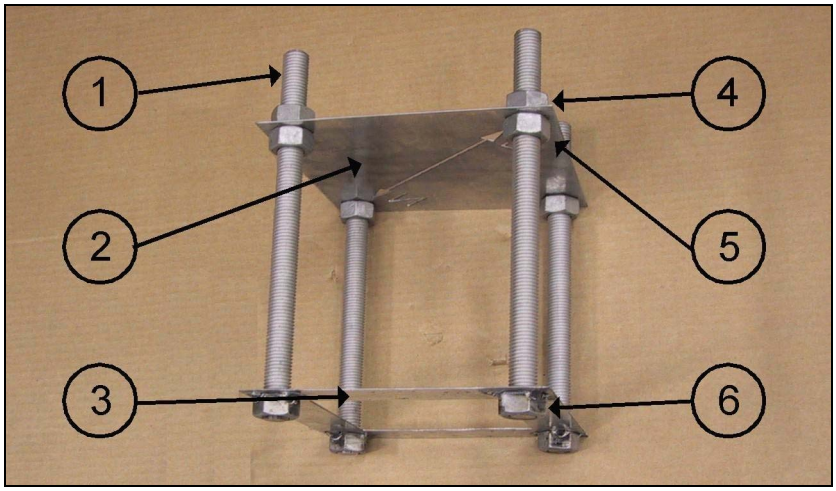

Figure 41 Foundation Assembly for the Mast Base

6. Install the foundation assembly into the mould so that the foundation bolt threads stand above the surface, see Figure 38 on page 54. The orientation plate (number 4 in Figure 42 on page 58) should be at the same height as the top of the finalized concrete pad. Also check the correct alignment of the foundation assembly with the orientation plate (number 4 in Figure 42 on page 58). "N" should face north and "S" should face south.

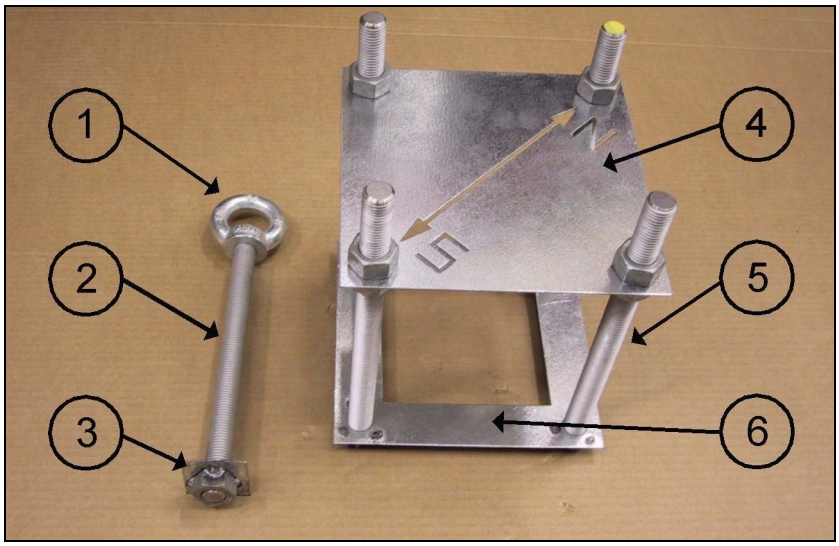

Figure 42 Foundation Assemblies for a New Concrete Pad

7. For the guy wires, fix the foundation bolt (number 2 in Figure 42 above) to the plate with a nut (3). Fix the eye nut (1) to the other end of the foundation bolt. Level the assembly so that the top of the bolt will be 40 mm above the concrete in the finalized block. The eye nut will then be one centimeter above the finalized concrete pad.
8. Pour in the concrete. Finish the concrete pad.

Using an Existing Concrete Pad

NOTE	The transformation for the dimensions in this section: 5 mm ≈ 0.20 in. 25 mm ≈ 0.98 in. 240 mm ≈ 9.45 in.

1. Drill holes with a diameter of 25 mm into the concrete pad using the orientation plate as a guide. Make sure that the depth of the holes is 240 mm (±5 mm).

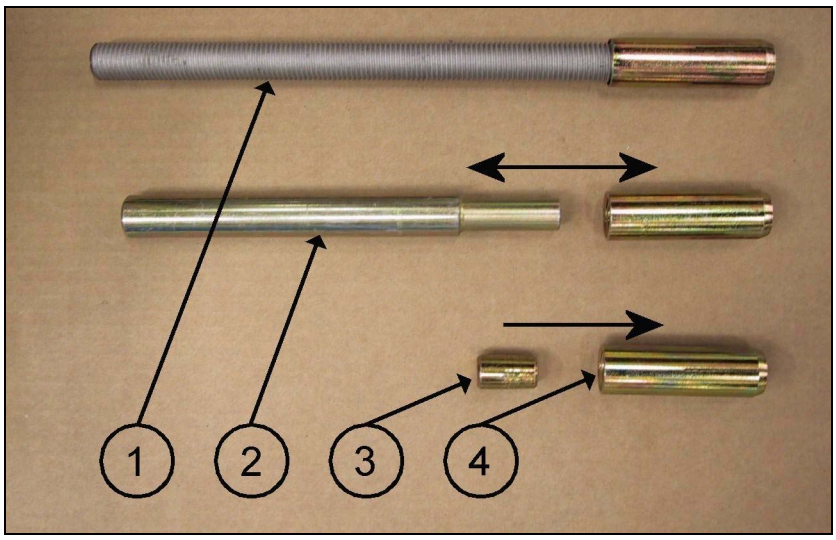

Figure 43 Accessories for Existing Concrete pad Installation

2. First, install the key piece (number 3 in Figure 43 above) correctly inside the wedge bolt (4). The narrow end should point to the direction of the lower arrow in Figure 43 above. Assemble the wedge bolts into the holes. There are four bolts for the mast base and one bolt for each of the guy wire pads.
3. Hammer the wedge bolts (4) down using the provided bar (2).
4. Screw the foundation bolts (1) to the wedge bolts and tighten the screws properly.
5. Fill the remaining space of the holes with a suitable compound.
6. Start assembling the mast after the compound is dry.

Assembling the Mast

Work Order

To assemble the mast, follow the work order below:

1. Attach the 2-meter-high pedestal tube to the concrete foundation.
2. Lift the lower base of the mast to the upper end of the pedestal tube and assemble the hinge axle.
3. Attach the lifting rod to the clamp that is preinstalled to the lowest mast tube.
4. Attach the guy wires to the uppermost mast tube.
5. Connect the mast tubes together.
6. Lift the upper end of the mast on the tilting support.
7. Assemble the holders to the lightning rod and attach the assembly to the mast.
8. Attach the winch and route the winch wire to the appropriate guides.
9. Install any other devices that will be installed to the tiltable part of the mast and attach the cables to the mast with cable ties.
10. Attach the jacketed copper grounding wire to the insulated guy wire with the cable ties.
11. Erect the mast with the winch and secure the hinge with the bolts.
12. Connect the guy wires with fasteners to their foundations and mark them with the cable shrouds.
13. Remove the winch and assemble the devices to the pedestal tube.

For detailed instructions, refer to the following sections.

Installing the Pedestal Tube

1. Turn the pedestal tube so that the plate lug faces south in the northern hemisphere and north in the southern hemisphere, see Figure 44 below. The plate lug is for attaching the guide for the winch wire.

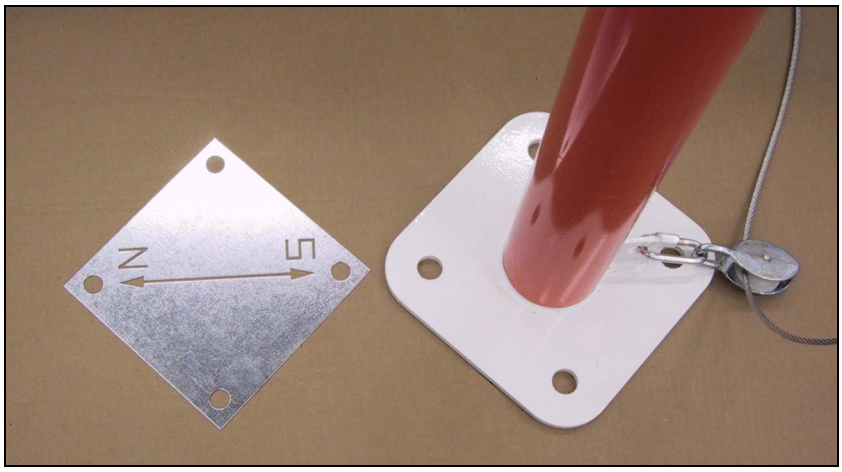

Figure 44 Pedestal Tube Alignment to North-South Direction

2. First place the washers and then the spring washers onto the previously installed nuts and lift the pedestal tube through the bolts onto the washers.
3. Install the nuts with the washers and spring washers to the foundation bolts. Refer to Figure 45 below.

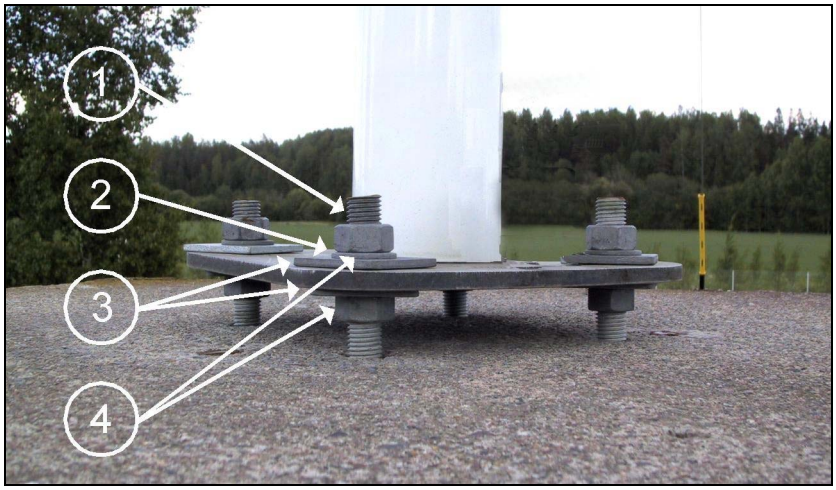

Figure 45 Pedestal Tube Attachment

The following numbers refer to Figure 45 on page 61:

1 = Foundation bolt
2 = Spring washers, under and above the plate
3 = Washers, under and above the plate
4 = Nuts, under and above the plate

NOTE	The delivered washers may differ from the ones shown in Figure 45 on page 61.

4. Level the pedestal tube to vertical with the nuts that are under the plate. For adjusting the level, use the appropriate wrench and a water level to check that the pedestal tube is vertical. Refer to Figure 46 below.
5. Finally, tighten the bolts with appropriate wrenches.

Figure 46 Pedestal Tube Adjustment with Water Level

Connecting the Lowest Mast Tube to the Pedestal Tube

To connect the lowest mast tube to the pedestal tube, install the axle for the hinge. For installing the axle, follow the procedure below:

1. Take the axle (number 1 in Figure 47 below) for the hinge from the plastic bag labeled Hinge Set.

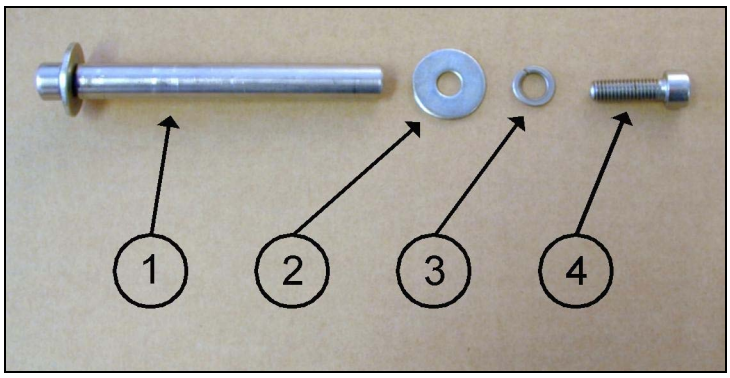

Figure 47 Axle for Hinge

2. Thread the Allen bolt (4) with the washers (2 and 3) to either end of the axle.
3. Lift the mast end (3) on the hinge (1) and install the axle (2), see Figure 48 below.

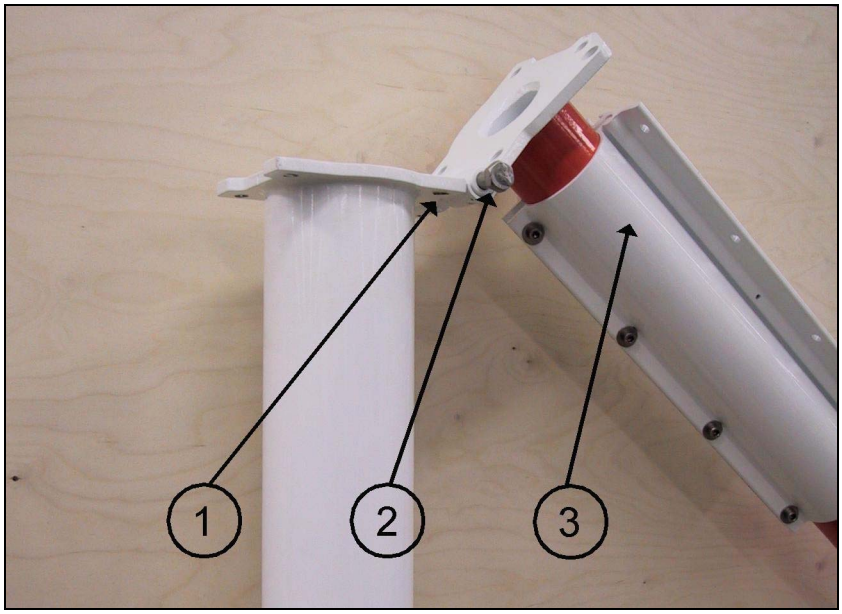

Figure 48 Hinge Axle Installation

4. Thread the other Allen bolt to the axle and tighten both ends with the Allen key.

Connecting the Lifting Rod to the Mast

The delivery contains the lifting rod that is used with the winch to erect and tilt the upper mast assembly. The clamps are preinstalled at the factory to the lifting rod and to the lowest mast tube. The clamp on the lifting rod has hooks (number 1 in Figure 49 below) and taps (2) to ease the installation. The stainless steel bolts (3) are included in the Lifting Rod Assembly Set (4).

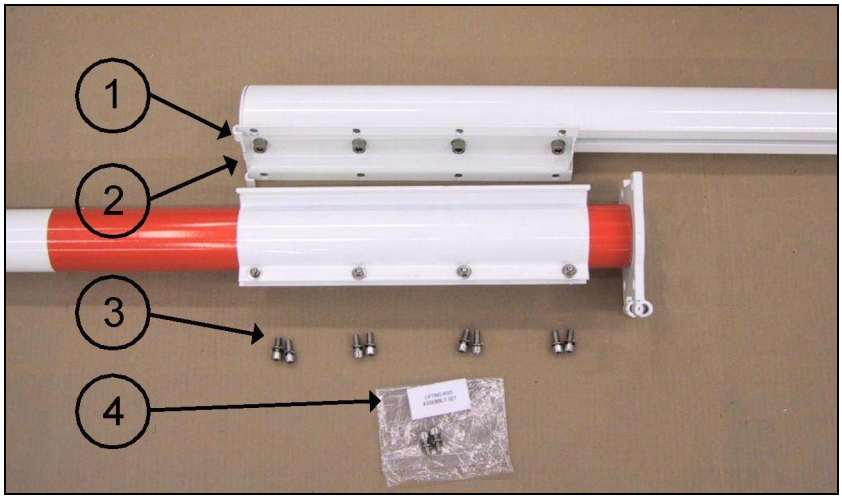

Figure 49 Lifting Rod Installation Accessories

To attach the lifting rod to the previously installed lower mast tube, follow the procedure below:

1. Place the lifting rod (number 1 in Figure 50 on page 65) on the mast assembly as shown in Figure 50 on page 65.
2. Make sure that both taps on the clamp go into the railing and the hooks (number 3 in Figure 50 on page 65) at the end of the clamp go firmly around the opposite clamp.
3. Install the bolts (number 2 in Figure 50 on page 65) with the washers and tighten them with the Allen key.

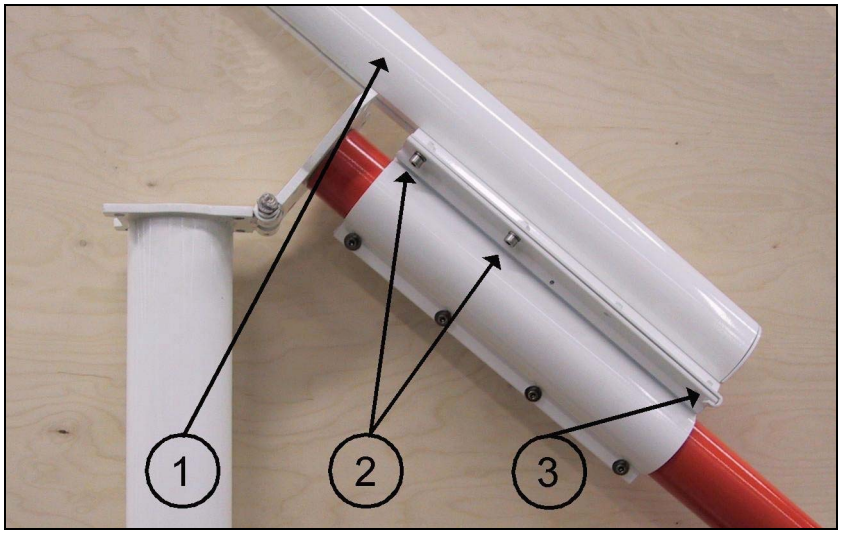

Figure 50 Lifting Rod Clamp Attachment

Connecting the Guy Wire Set to the Mast

When using the DKP206AV-T mast, assemble the top fastener next to the tapered edge (number 3 in Figure 51 on page 66). When using the DKP210AV-T mast, assemble the top fastener of the basic guy wires (DKP210GW-1) to the narrowing which is located approximately 0.98 m (3.2 ft.) from the top of the mast. In addition, assemble the top fastener of the additional guy wires (DKP210GW-2) in the middle of the ∅ 63 mm mast tube, that is, 4 meter (13 ft.) downward from the top of the mast.

To assemble the top fastener of the guy wires, follow the procedure below:

1. Install the clamps (number 1 in Figure 51 on page 66) around the mast with the bolts (2) to assemble the top fastener. Aim the guy wire that is equipped with the shackle to the groove on the tube. Aim the insulated guy wire so that it points to the concrete pad in northwest (in the Northern hemisphere), refer to Figure 36 on page 52 and Figure 37 on page 53.
2. After installing the lightning rod, you should align the lightning rod holders to the same direction with the insulated guy wire, see Figure 55 on page 69.

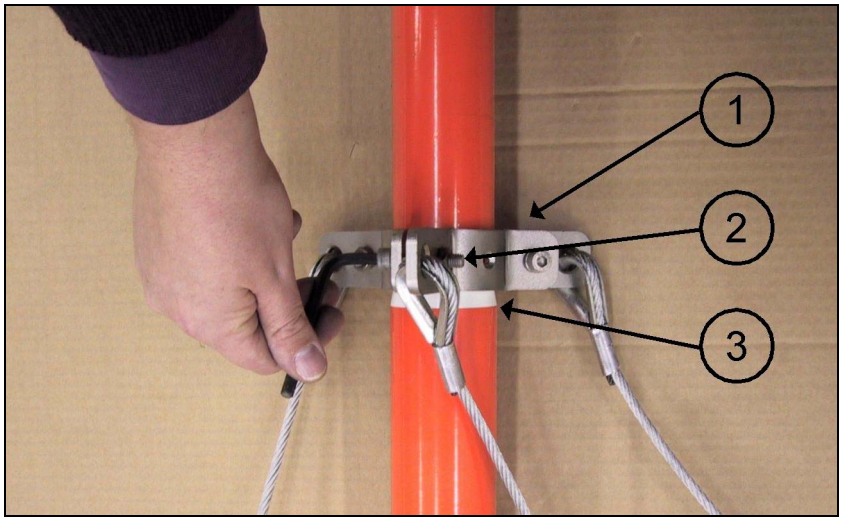

Figure 51 Guy Wire Attachment

Assembling the Mast Tubes

The upper mast tube(s) has the O-ring (number 1 in Figure 52 below) installed on the tube.

For connecting the mast tubes, use lubricant to make the O-ring slippery and simply slide the mast tubes together. You need to rotate either of the tubes to align the groove (2) on the upper tube and the ridge (3) inside the lower mast tube, see Figure 52 below.

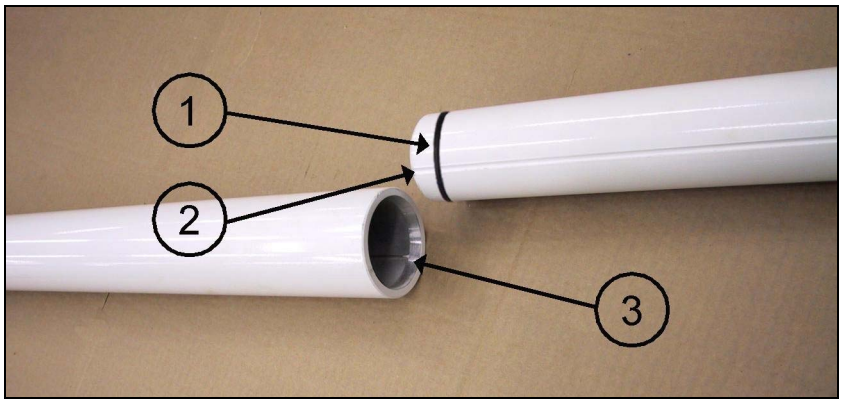

Figure 52 Alignment of the Mast Tubes

Assembling the Lightning Rod

Lightning protection is provided with a well-grounded lightning rod placed to the highest point of the mast. The lightning rod is completely insulated from other mast construction and separately connected to its own lightning ground rod(s) several meters away from other equipment ground rod(s). A 25 mm² grounding cable is routed down from the top of the mast via the insulated guy wire. See Figure 55 on page 69.

To install the lightning rod, follow the procedure below:

1. Slide the lightning rod to the holes in the holders. See Figure 53 below.
2. Attach the lightning rod to the holders with the bolts (number 1 in Figure 53 below).
3. Slide the obstruction light holder (2) to the mast between the lightning rod holders and tighten the nuts (3).

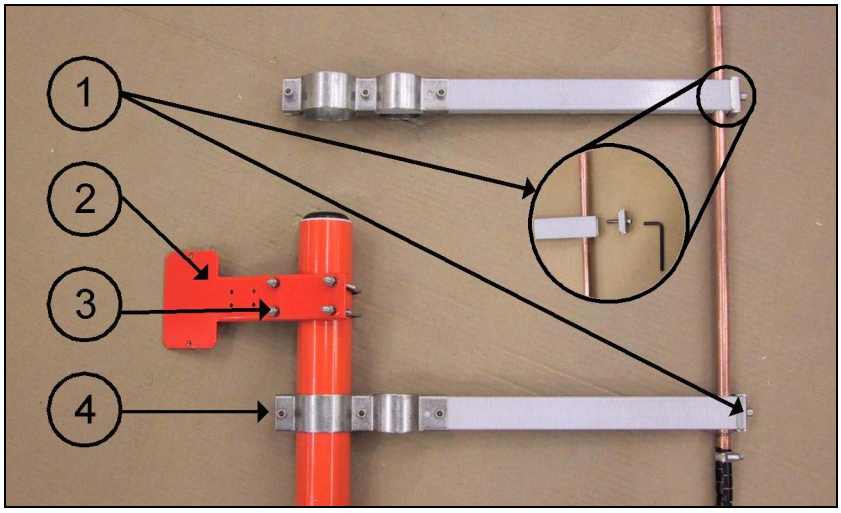

Figure 53 Lightning Rod Installation to the Mast

4. Secure the holders to the mast with the bolts in the clamps (4).
5. Check that the dimensions for the installed lightning rod are as illustrated in Figure 54 on page 68.

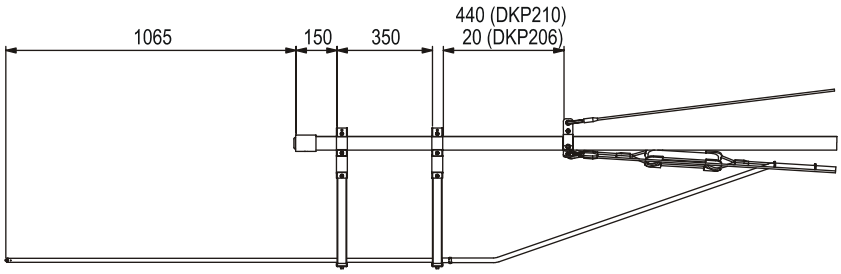

Figure 54 Dimensions (in mm) for Lightning Rod Assembly on the Mast

NOTE

The transformation for the dimensions in Figure 54 above:
20 mm ≈ 0.79 in.
150 mm ≈ 5.91 in.
350 mm ≈ 13.8 in.
440 mm ≈ 15.7 in.
1065 mm ≈ 41.9 in

Connecting the Grounding Cable to the Insulated Guy Wire

Before erecting the mast, connect the grounding cable to the insulated guy wire as follows:

1. Aim the insulated guy wire so that it points northwest (in the northern hemisphere) when the mast is erected. The lightning rod holders are aligned to the same direction as the insulated guy wire, see Figure 55 on page 69.
2. Attach the grounding cable (number 3 in Figure 55 on page 69) with a wire rope clip (5) below the insulator (4).

NOTE

Leave some extra cable between the lightning rod and the wire rope clip on the guy wire to ensure that the guy wire does not pull the lightning rod downwards.

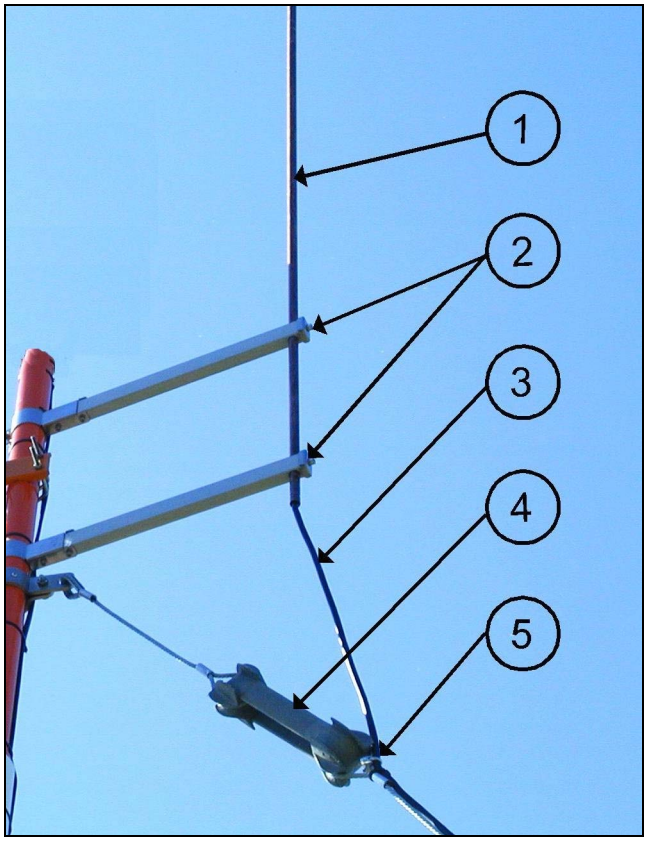

Figure 55 Lightning Rod Cable Attachment

The following numbers refer to Figure 55 above.

1 = Lightning rod
2 = Lightning rod holders
3 = Grounding cable
4 = Insulator
5 = Wire rope clip

Routing the Device Cables

Before erecting the mast, route the device cables from the top of the mast on the hinge side to avoid possible damage to the cables when tilting the mast. It is also important to attach the cables to the mast with the cable ties. The recommended distance between the cable ties is from 30 to 40 cm (11 to 16 in.).

Erecting the Mast

NOTE	Before erecting the mast, refer to the installation instructions of the additional sensors and devices. It is important to aim the sensors correctly before erecting the mast.

Before erecting the mast, check that the bolts of the top fastener are tight. The top fastener (number 1 in Figure 17 on page 30) is mounted on the upper mast tube.

Installing and Using the Winch

It is always recommended to use the winch for erecting the mast. The winch is easy to install and should be removed after use.

1. Attach the handle (number 5 in Figure 56 below) to the shaft of the winch.

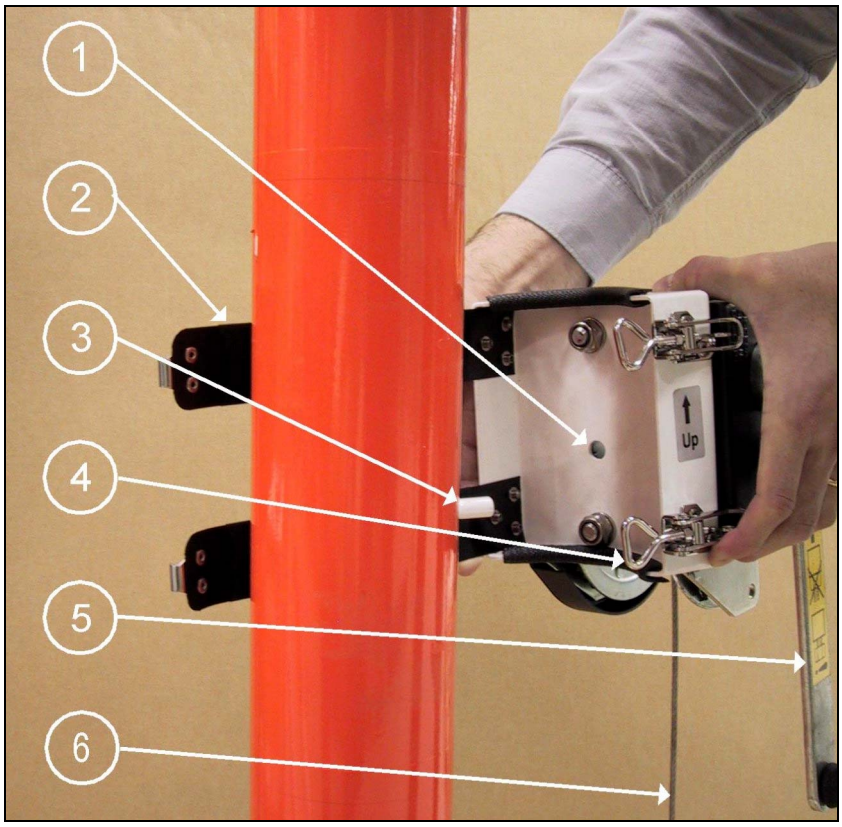

Figure 56 Winch Installation

2. Install the winch towards the pedestal tube so that the tap (3) on the tube goes to the hole (1) on the winch. Make sure that the arrow on the winch faces up.
3. Wrap the clamps (2) around the tube to the clamp assemblies (4) and attach them.
4. Finally, secure the clamps with the provided pin clips as shown in Figure 57 below.

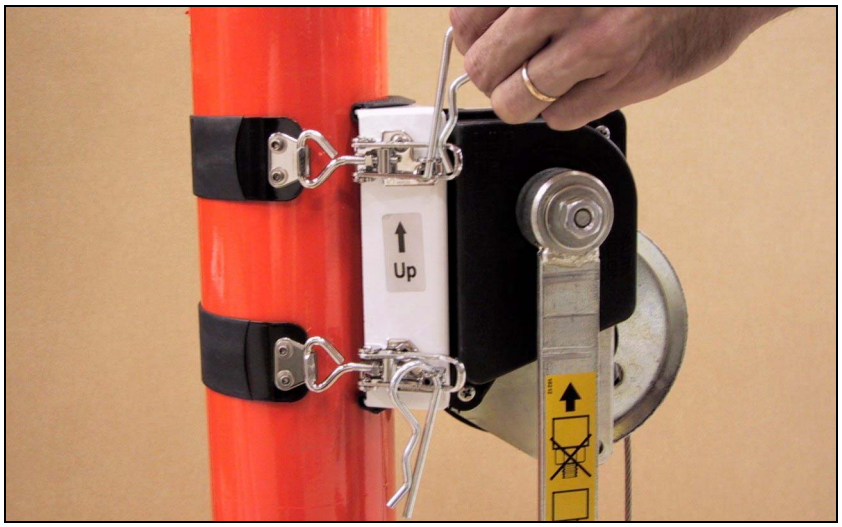

Figure 57 Securing the Clamp of the Winch

5. Attach the cable bearer (number 4 in Figure 58 below) with the shackle (2) to the plate lug (3) of the pedestal plate. Make sure that the end of the wire (1) with the spring clip points east (when installing in the northern hemisphere).

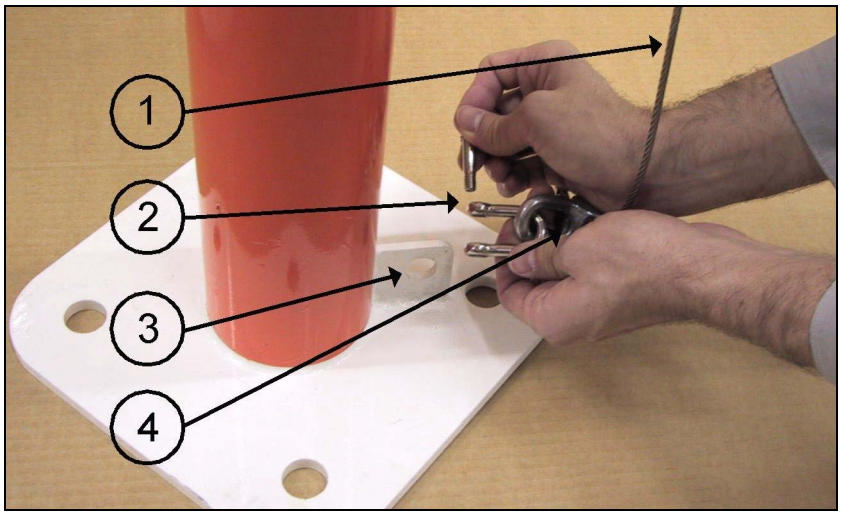

Figure 58 Lower Cable Lead

6. Clip the spring clip (number 1 in Figure 59 below) to the plate lug (2) of the lifting rod.

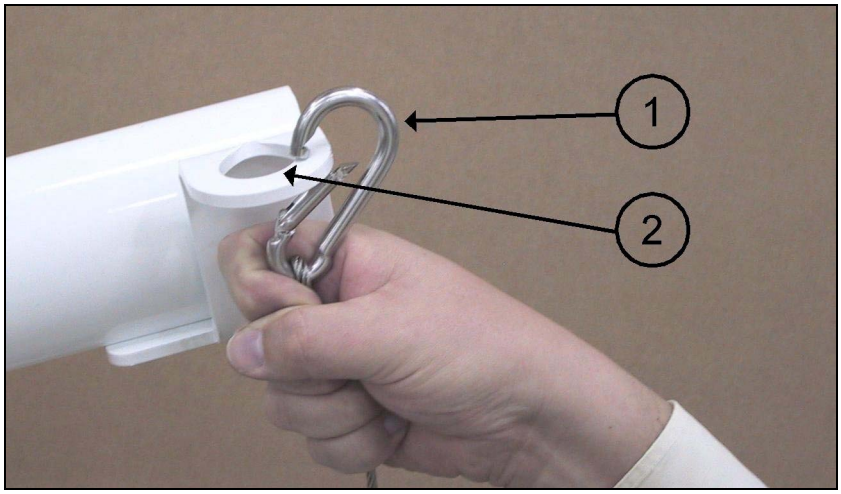

Figure 59 Attaching the Spring Clip

7. Take a good grasp on the handle and turn it clockwise to erect the mast. The winch is equipped with the friction break and thus, it stops automatically when you release the handle.

WARNING	Make sure that there are no persons under the mast when the mast is being erected.

WARNING	When erecting the mast with the winch avoid touching the wire with your bare hands. Do not try to guide the wire.

WARNING	Always wear gloves when using the winch. Do not touch the gears of the winch.

WARNING	Never leave the tilted mast resting on the winch, always use the tilting support.

Securing the Hinge

After erecting the mast, secure the hinge with the provided accessories as illustrated in Figure 60 below.

NOTE	Always assemble the washers under the spring washers to prevent the paint from being damaged.

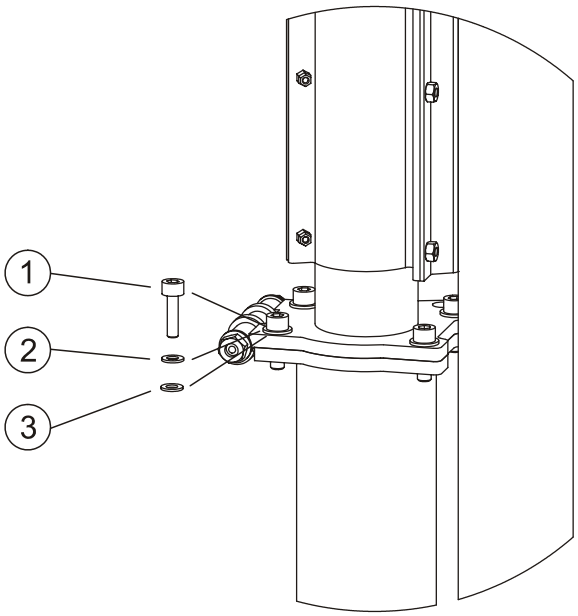

Figure 60 Bolts and Washers for Securing the Hinge

The following numbers refer to Figure 60 above:

1 = Allen bolt
2 = Spring washer
3 = Washer

Connecting the Guy Wires to the Concrete Pads

WARNING	Always wear gloves when handling the guy wires.

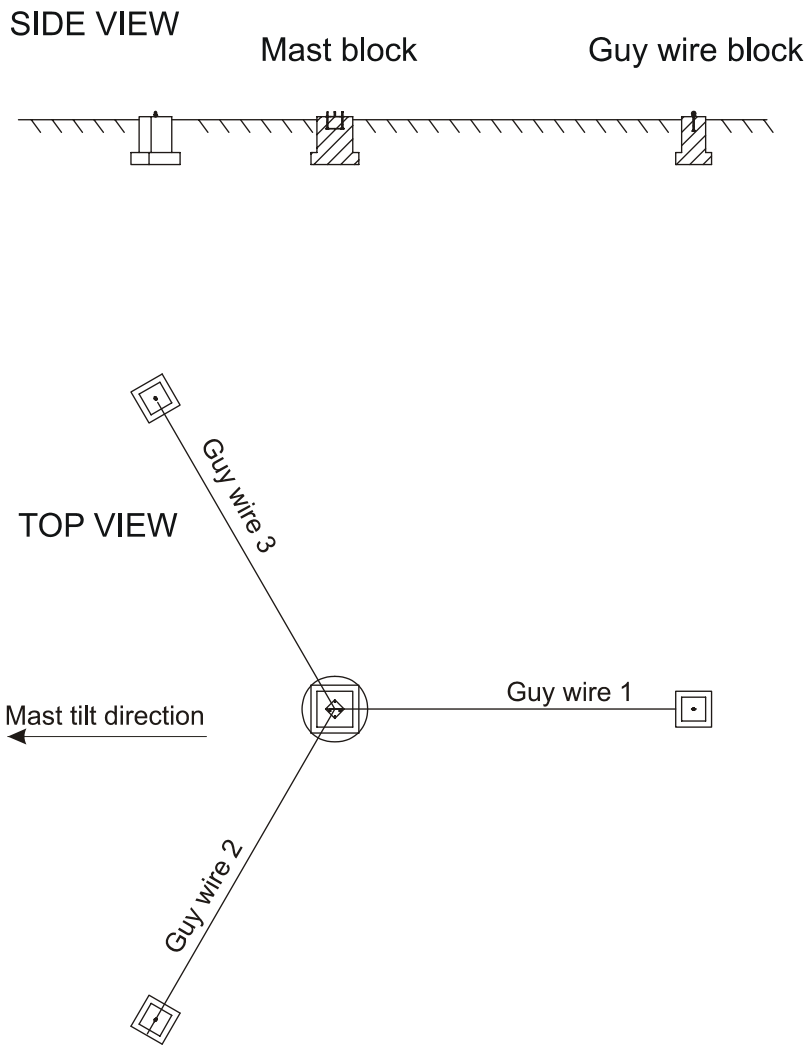

Figure 61 Guy Wires

Follow the procedure below to connect the guy wires to the concrete pads:

1. Connect the guy wires 2 and 3 as instructed in step a. below and connect the guy wire 1 as instructed in step b. below. The guy wire 1 is installed differently from the others, because it is

released when the mast is tilted. For the location of the guy wires, refer to Figure 61 on page 74.

a. For the guy wires 2 and 3, connect the U-bolt (number 2 in Figure 62 below) to the eye bolt (1) installed on the concrete pad. Slide the strap (3) onto the U-bolt and thread the nuts.

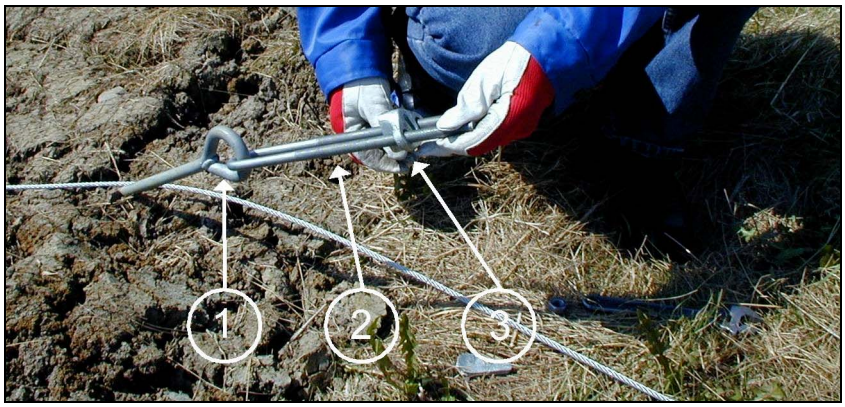

Figure 62 Connecting the U-bolt to the Eye Bolt

b. For the guy wire 1, connect the U-bolt (number 3 in Figure 63 below) to the eye nut (1) with an additional bow shackle (2) to enable easy releasing of the wire. The strap (4) is used as with guy wires 2 and 3.

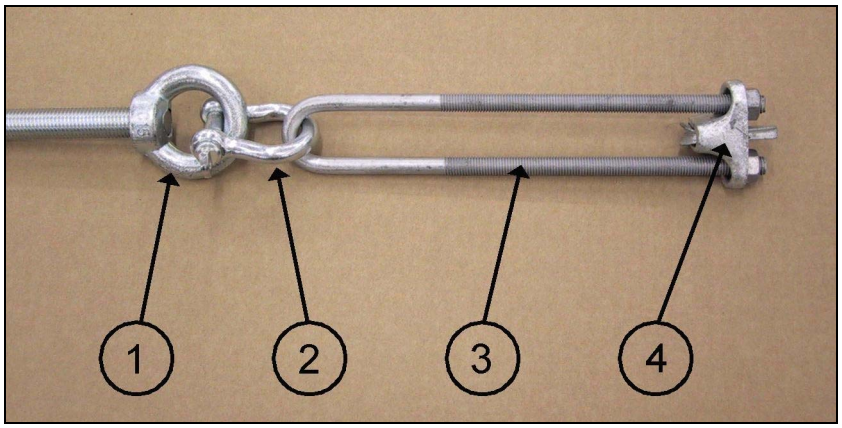

Figure 63 Guy Wire 1 Attachment

NOTE	The additional bow shackle (number 2 in Figure 63 above) may differ from the one shown in the figure.

2. Secure the guy wires with the provided wire rope clips (number 3 in Figure 64 below). Place the wire rope clips on the wire so that the forged, grooved part clamps the wire coming from the mast (the tension side) and the U-bolt clamps down on the end-most section of the wire. Also check that the wire is properly in the key groove (1).

3. After assembling the wire rope clips properly, strain the guy wire by tightening the nuts (2) to slide the strap, until the initial tension of the guy wires is sufficient. When tensioning the guy wires, make sure that the mast remains straight and that all the guy wires are equally tensed.

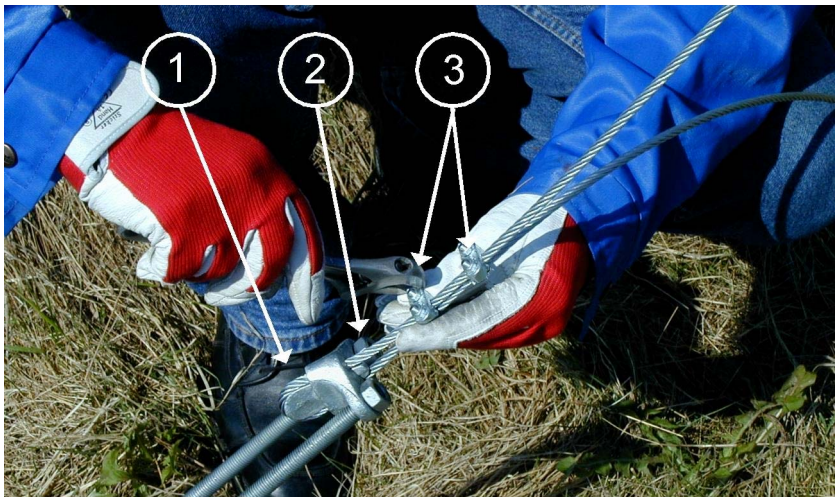

Figure 64 Securing the Guy Wires

4. Cut the extra guy wire.

5. Finally, place the black and yellow cable shrouds around the guy wires, see Figure 65 on page 77. There is one package of shrouds for each wire.

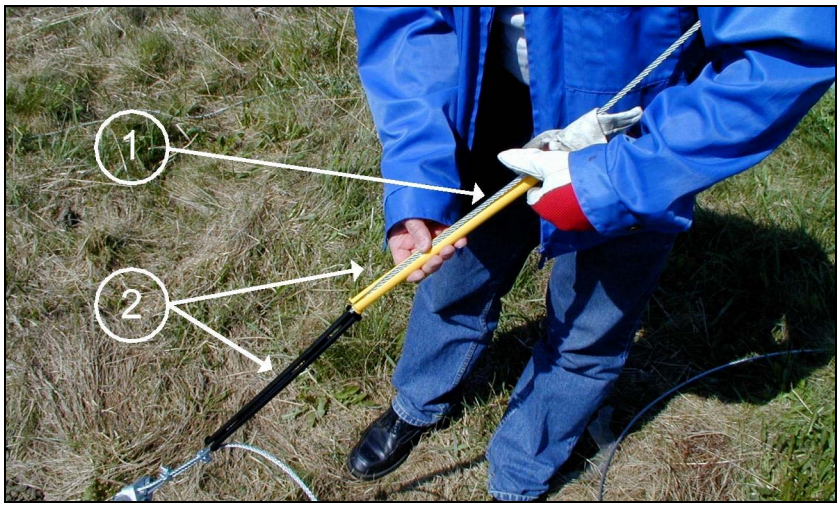

Figure 65 Installing Cable Shrouds

The following numbers refer to Figure 65 above.

1 = Guy wire
2 = Cable shrouds

Equipment Grounding and Lightning Protection

With mast installations equipment grounding and lightning protection must be done separately. The main principles are described below:

- Proper equipment grounding is required for personnel safety and for equipment protection. A piece of equipment is grounded by connecting its metal structures and electrical equipment to an external buried ground rod. Individual site requirements may dictate changes in the procedures described in this manual. Changes are permissible as long as equivalent protection to the original requirements is provided for the system.

- The materials used in the manufacture of the grounding systems must be chosen to prevent them from forming an electrolytic couple. It is recommended to use copper (Cu).

WARNING	Failure to provide proper grounding may result in personnel injury or death from electrical shock and may severely damage equipment.

WARNING Lightning protection is required to prevent personnel injury and equipment damage due to direct lightning strikes and lightning-induced current surges.

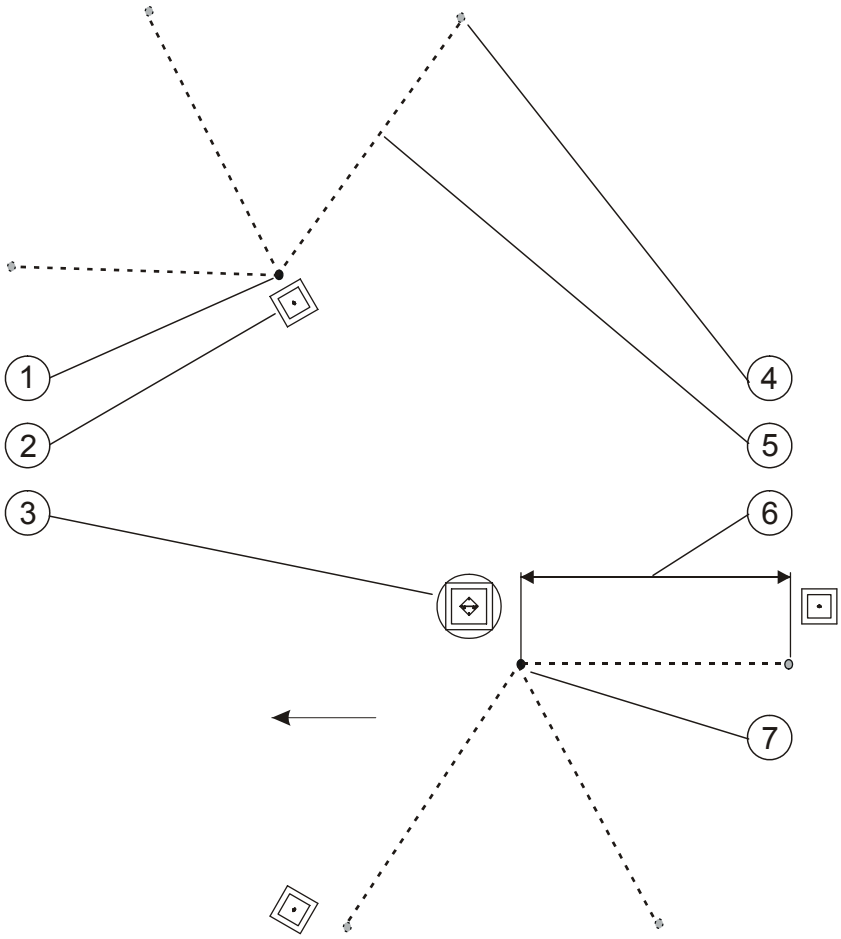

Figure 66 Location of the Grounding Rods and an Optional Grid, the Arrow Points to the Mast Tilt Direction

The following numbers refer to Figure 66 above.

1 = The grounding rod for lightning ground
2 = The guy wire block of the insulated guy wire
3 = The mast block
4 = An optional grounding rod
5 = An optional connecting cable
6 = The 5-meter minimum distance between the rods
7 = The grounding rod for equipment ground

- The equipment grounding system and lightning protection grounding system should be located as far as possible from each other. Minimum recommended distance is 5 m (16 ft.). Due to this the lightning rod grounding cable is routed down from the top of the mast via the guy wire which is insulated from the mast construction, refer to number 2 in Figure 66 on page 78. The equipment grounding should be done near the concrete pad for the mast as illustrated in Figure 66 on page 78.
- The recommended grounding resistance is 10 Ω or less for both the grounding of lighting protection rod and for the equipment grounding. Soil conditions (sand, rocks, etc.) and ground resistance measurement determines the design and construction of the grounding system. Buried ground rods and / or buried wire can be used for the ground network. The type and combination used depend on soil conditions (ease of installation) and on the value of measured ground resistance (the most effective way of reducing resistance to the required value of 10 Ω or less). Measurements of the earth resistance shall be made at least 48 hours after rainfall.
- The connection between ground rods and equipment frames and copper cables should be made with appropriate compression lugs, bolts, nuts, and lock washers.
- Optionally, the top of the earth electrode can be housed inside covered pit as illustrated in Figure 67 on page 80.

Table 3 Examples of Soil Resistivities, Ohm-Meters

Soil Type	Median	Variation
Topsoil, loam	26	1 ... 50
Inorganic clays of high plasticity	33	10 ... 55
Silty or clayey fine sands with slight plasticity	55	30 ... 80
Fine sandy or silty clays, silty clays, clean clays	190	80 ... 300
Silty sands, poorly graded sand-silt mixtures	300	100 ... 500
Well graded gravel, gravel sand mixtures	800	600 ... 1 000

Due to the above reasons and variations, the grounding accessories presented in this manual (rods, connectors, etc.) are only examples of the proper ones, thus recommended to be supplied locally.

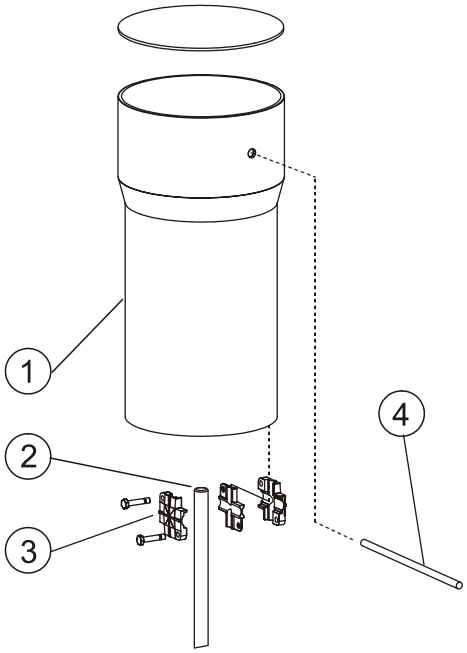

Figure 67 Ground Rod Installation

The following numbers refer to Figure 67 above:

1 = Access well
2 = Grounding rod
3 = Compression lug
4 = Grounding cable

Equipment Grounding

The equipment grounding cable is connected to the equipment ground system (rod or other) from the one main grounding point, which is normally a grounding bar located underneath the main system enclosure.

CAUTION	Always use clamps for connecting a cable to the grounding rod or two cables together, do not solder.

Consult the local authority for local grounding requirements. A copper grounding cable and conductive grounding rod(s) are recommended. Usually, the customer is responsible for supplying grounding cables, rods, clamps, power cables, long distance signal cables, and conduits for cables.

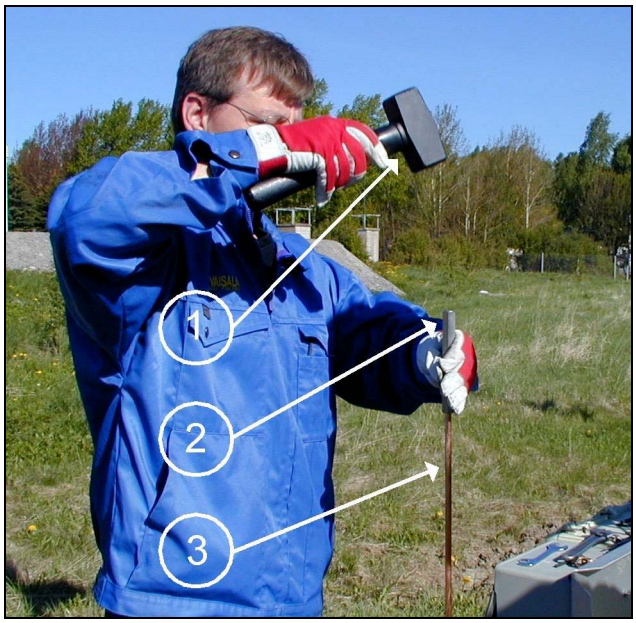

Figure 68 Installing the Grounding Bar

The following numbers refer to Figure 68 above.

1 = Hammer
2 = Protective cap
3 = Grounding bar

NOTE	The grounding accessories shown in Figure 68 above are examples of the grounding accessories. It is recommended to supply them locally.

Silver epoxy material or equivalent should be used to bond the interconnecting wire to the ground rods. Cross section of interconnection copper wire is recommended to be 25 mm^2. The length should be about 2 meters. The 2-meter cable can be obtained by first cutting the connection cable of the lightning rod to the correct length. The rest of the cable can be used for grounding the equipment. The original length of the cable is 15 m.

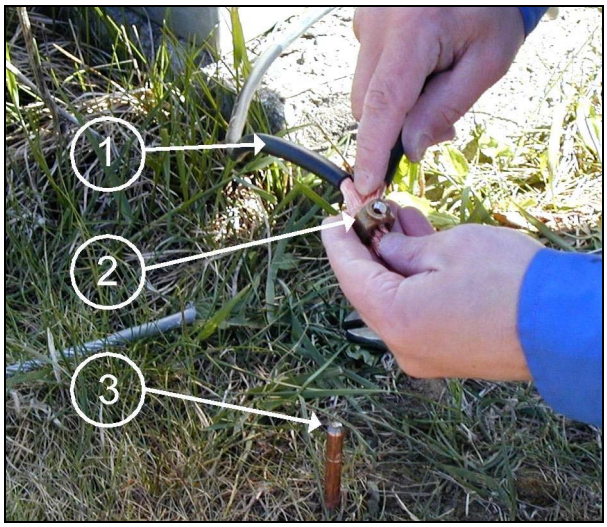

Figure 69 Connecting the Grounding Cables to the Bar

The following numbers refer to Figure 69 above.

1 = Grounding cable
2 = Clamp
3 = Grounding bar

It is recommended to protect the grounding cable on the surface of the concrete pad as illustrated in Figure 70 below. This applies only when the mast is installed on an existing concrete pad. It is recommended to use a conduit when you cast the pad for the mast.

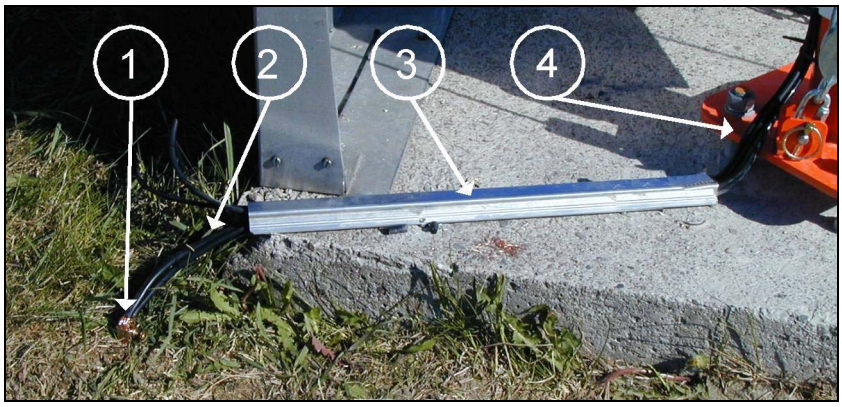

Figure 70 Grounding Cable Protection

The following numbers refer to Figure 70 on page 82.

1 = Clamp
2 = Grounding cables, for the Lightning Detector and Power Supply Unit
3 = Plate to protect the grounding cables and the AC power cable
4 = Mast base

Grounding of the Lightning Rod

The lightning rod is grounded in a similar way to the equipment grounding. The lightning rod is grounded near the concrete pad for the insulated guy wire, see Figure 71 below.

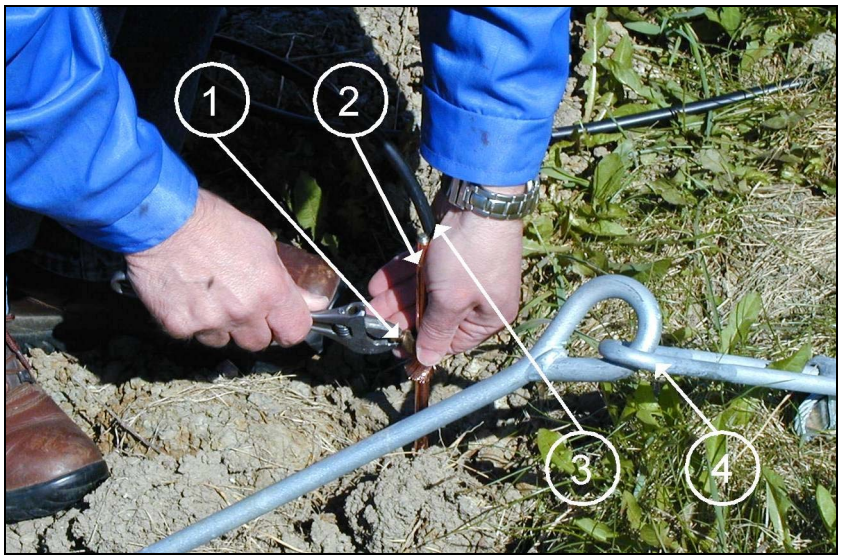

Figure 71 Grounding of the Lightning Rod

The following numbers refer to Figure 71 above.

1 = Clamp
2 = Rod
3 = Cable from the lightning rod
4 = Guy wire attachment

Tilting the Mast

You need to tilt the mast, for example, when devices installed on the upper assembly need to be aligned. The following sections provide you with instructions on tilting the mast.

Disconnecting and Securing the Guy Wire

1. Disconnect the guy wire 1 that is on the opposite side of the mast to the hinge. For the location, see Figure 36 on page 52.
2. Connect the spring clip mounted to the released guy wire to the hole in the hinge.

Using the Winch

1. Install the winch to the mast as instructed in section Installing and Using the Winch on page 70.
2. Open the securing Allen bolts in the hinge.

CAUTION	Do not open the Allen bolts in the horizontal hinge axle.

3. Lower the mast slowly with the winch by turning the handle counter clockwise.

CAUTION	Make sure to have a good grasp on the handle.

4. Install the tilting support to the end of the mast, see Figure 72 on page 85.
5. Lower the mast slowly with the winch so that the mast finally rests on the tilting support.

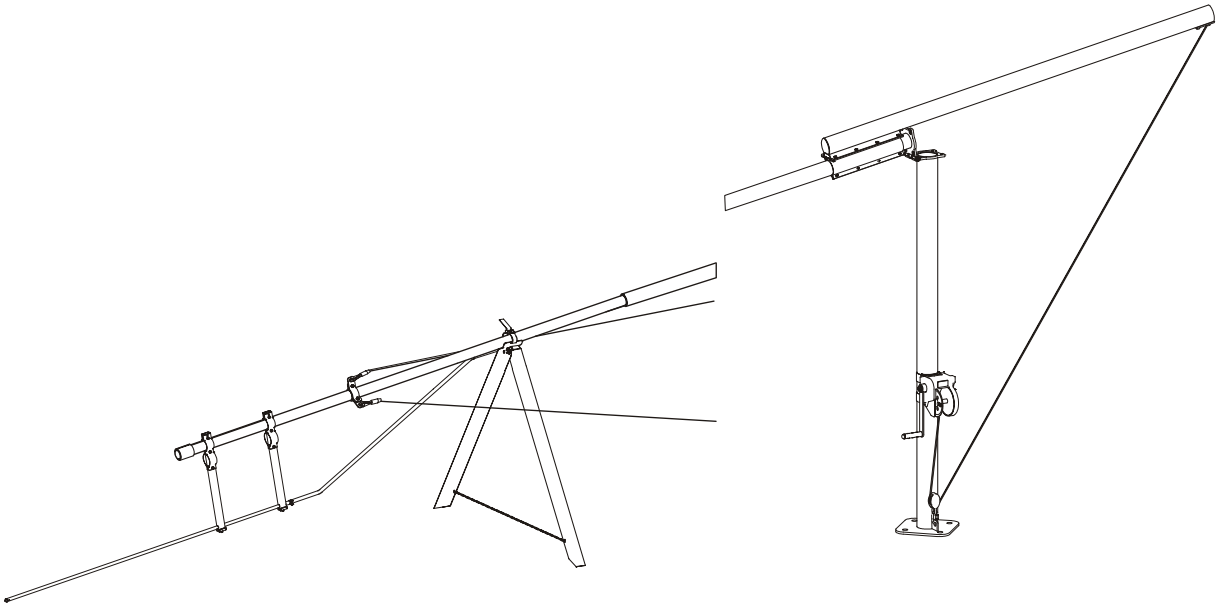

Figure 72 Tilted Mast with Tilting Support

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CHAPTER 4

INSTALLATION OF THE WEATHER STATION COMPONENTS TO THE MAST

This chapter provides detailed information on installing the weather station logger and all the sensors to the mast.

Preparing Installation

Tools for assisting the installation of the weather station components are provided. The following tools are supplied with the delivery:

- 3 mm, 4 mm, 5 mm, and 6 mm Allen keys
- Cable ties
- Cable shrouds for protecting the cables

One person can complete the whole installation after the mast is installed and it can be tilted and erected with the winch.

Unpacking Instructions

When you have received the delivery, check that the sensors have not been damaged during transportation.

NOTE	Store all the sensors and other devices in their shipping boxes until you install them to the mast.

Weather Station Structure

An example of the fully installed MAWS201MP weather station structure is shown in Figure 73 below.

NOTE	The mast may differ from the one presented in the figures.

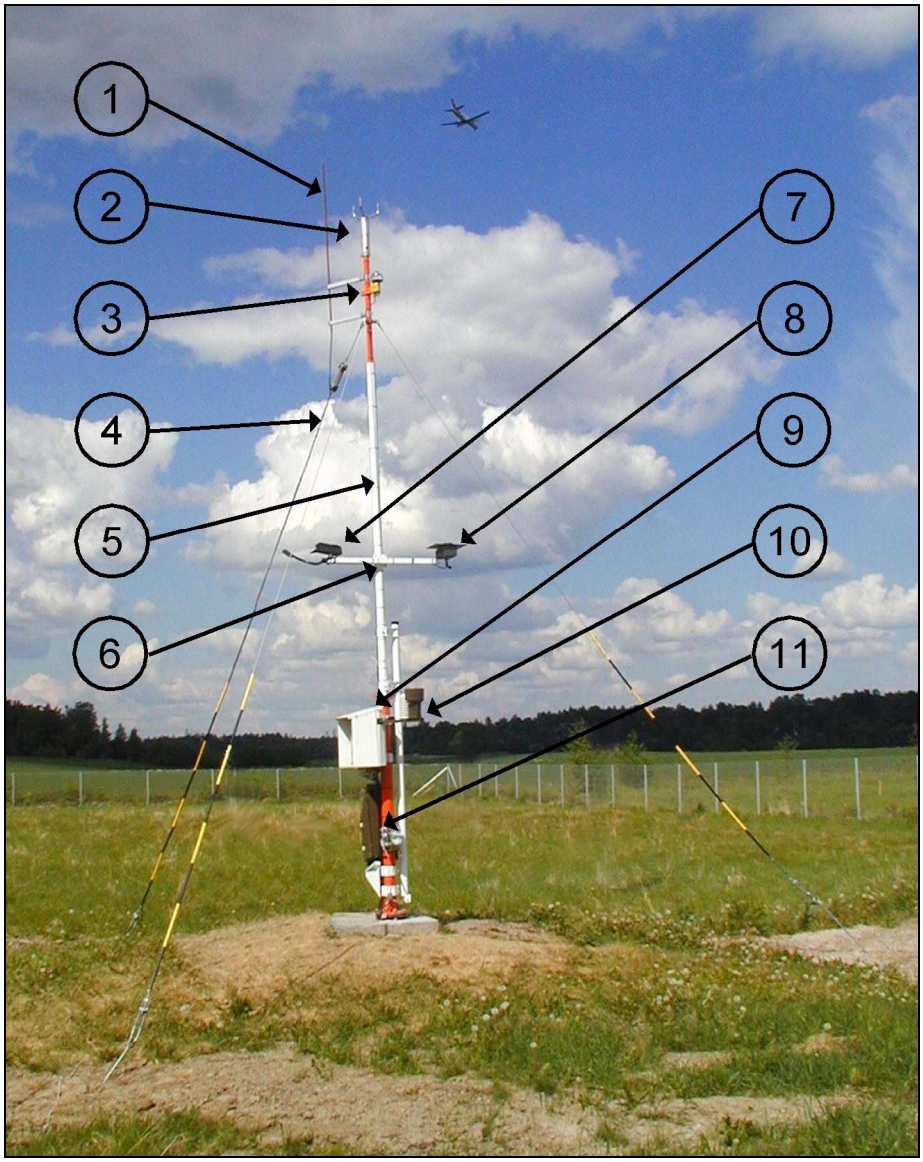

Figure 73 Mechanical Structure of MAWS201MP

The following numbers refer to Figure 73 on page 88.

1 = Lightning rod
2 = Heated Ultrasonic Wind Sensor
3 = Obstruction light
4 = Guy wires
5 = Tiltable mast
6 = Sensor arm
7 = Present Weather Sensor
8 = Lightning Detector
9 = Radiation shield protecting the logger tube and Power Supply and Connection Unit
10 = Sensor Arm with Rain Gauge and Air Temperature and Relative Humidity Sensor
11 = Ceilometer

Mounting the Radiation Shield

The radiation shield protects the logger tube and power supply and communication unit, which is equipped with AC/DC power supplies, battery regulator, backup battery, and communication devices. The rear view of the radiation shield is shown in Figure 74 below.

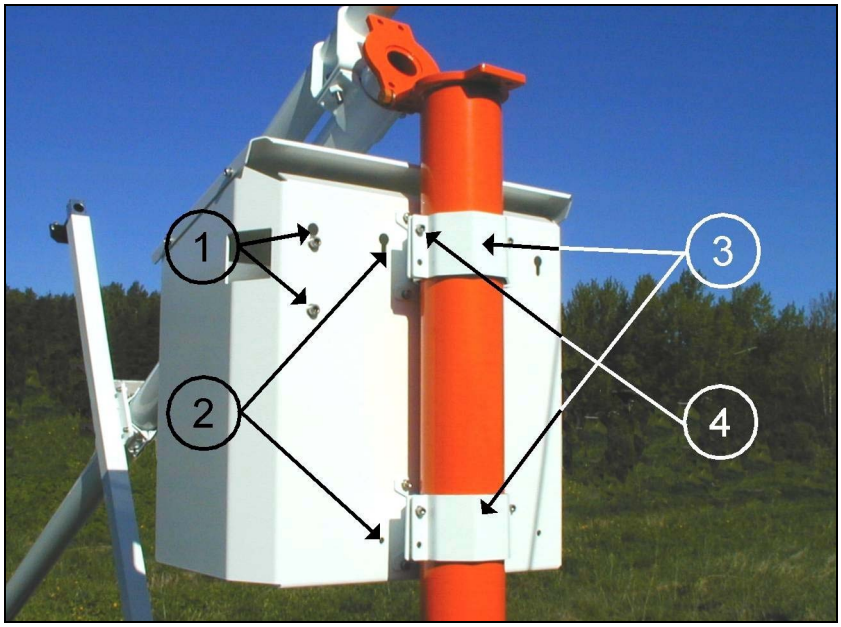

Figure 74 Mounting the Radiation Shield

The following numbers refer to Figure 74 on page 89.

1 = Two installation screws for attaching the logger tube to the radiation shield
2 = Four installation screws for attaching the power supply and communication unit to the radiation shield
3 = Two attachment brackets
4 = Eight installation bolts for assembling the brackets to the mast

CAUTION	Be sure that the radiation shield is not installed too high to prevent it from being damaged when the mast is tilted.

NOTE	To ease the installation of other components under the radiation shield, install the cover of the radiation shield last, not as shown in Figure 74 on page 89

NOTE	Always install the radiation shield on the west side of the mast (in northern hemisphere), that is, to the same side whereto the mast tilts.

Two mounting brackets are pre-assembled on the rear of the radiation shield. The brackets are intended for mounting the enclosure to the mast of ∅ 100 mm. To install the radiation shield, follow the procedure below:

1. Select the suitable installation height. It should be approximately 1.5 to 1.7 m. Eye height is recommended for the best working access.
2. Mount the brackets (number 3 in Figure 74 on page 89) with the bolts (4) that have the washers.

Mounting the Logger Tube

The logger tube is mounted under the radiation shield. Refer to Figure 75 on page 91 and Figure 76 on page 91 for mounting details.

1. Attach the mounting piece (number 1 in Figure 75 on page 91) to the logger tube (2) with one bolt (3).

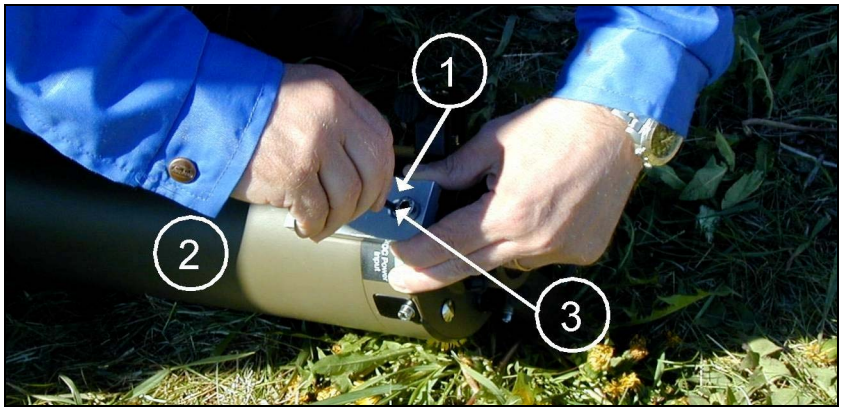

Figure 75 Installing the Mounting Piece to the Logger Tube

2. Mount the logger tube inside the radiation shield. Guide the mounting piece for the sensor arm (number 1 in Figure 76 below) through the opening (2) in the radiation shield.
3. Secure the installation with the bolt (3) using the Allen key (4). Install the other provided bolt to the lower hole.

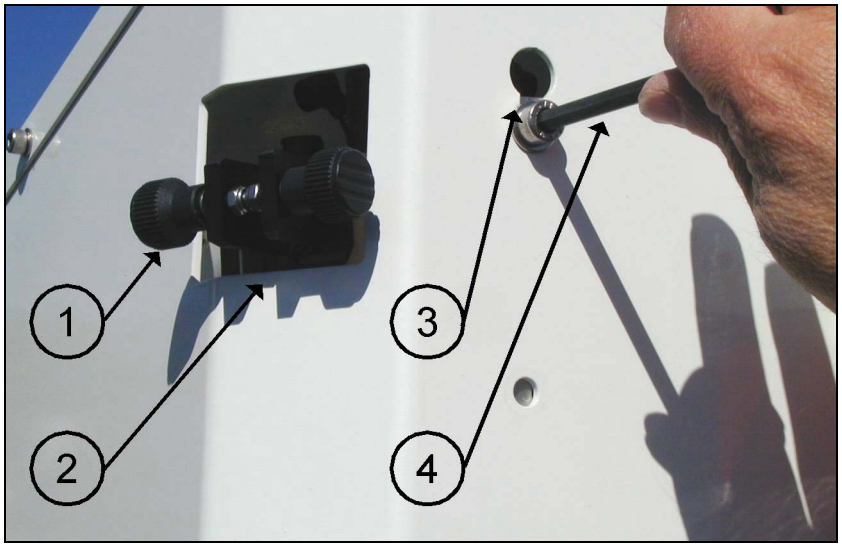

Figure 76 Mounting the Logger Tube

Mounting the QMP202MP Unit

The power supply and connection unit is mounted under the radiation shield beside the logger tube. Refer to number 2 in Figure 74 on page 89 for the location of the mounting holes. Secure the power supply unit with four bolts and washers as illustrated in Figure 77 on page 92.

After installing other devices to the mast, connect the cables to the QMP202MP unit as instructed in section Connecting the Cables on page 106.

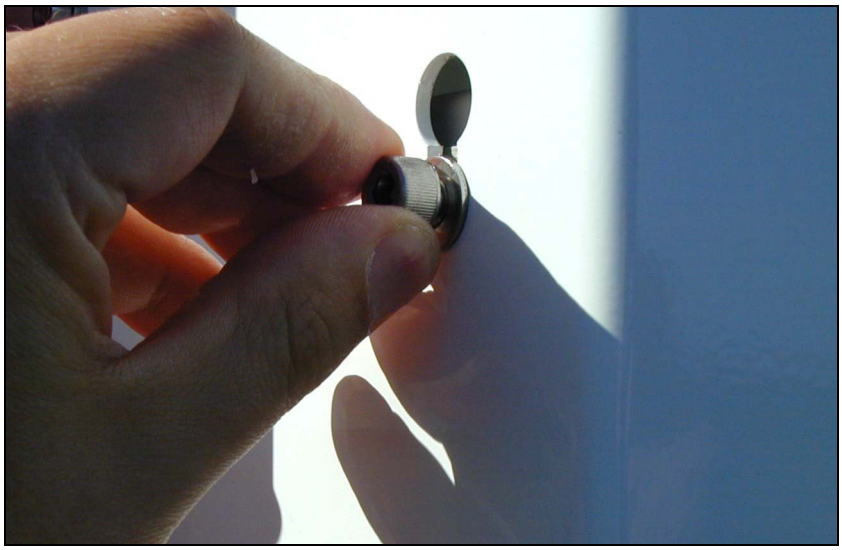

Figure 77 Mounting the Bolt and Washer for Power Supply Unit

Mounting the Obstruction Light

The obstruction light is installed to the holder that is installed between the lightning rod holders. To install the obstruction light, follow the procedure below:

1. Mount the obstruction light to the holder with two bolts (number 2 in Figure 78 on page 93).
2. Do not remove the paperboard cover (1) until you have completed the entire installation procedure and you are ready to erect the mast.
3. Route the cable (3) to the power supply unit and connect it to the power supply unit as described in section Connecting the Cables on page 106.

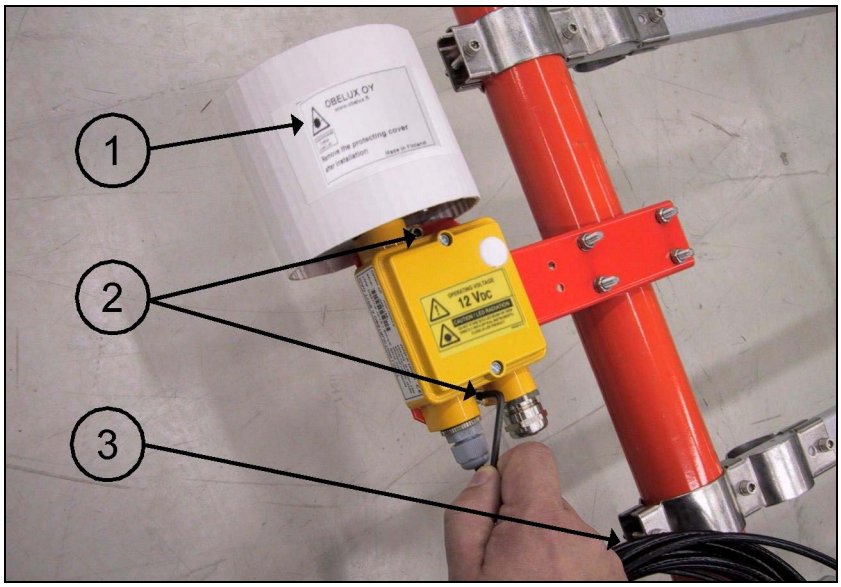

Figure 78 Mounting the Obstruction Light

Installing Sensors

CAUTION	Route the device cables from the top of the mast on the hinge side to avoid possible damage to the cables when tilting the mast. It is also important to attach the cables to the mast with the cable ties.

CAUTION	Be careful not to pinch cables during installation.

CAUTION	When connecting cables, be careful so that the connector pins do not bend.

Mounting QMA102M Sensor Arm

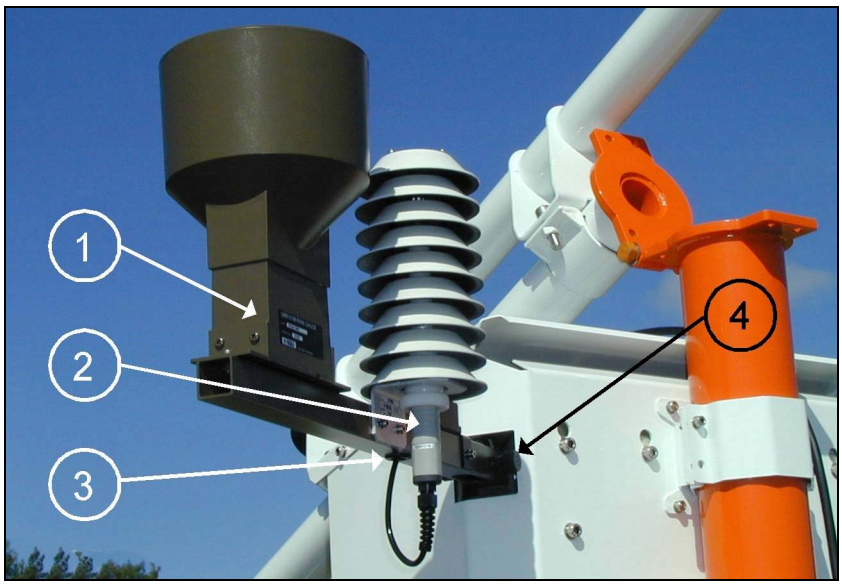

Figure 79 Mounting the Sensor Arm to the Logger Tube

The rain gauge (number 1 in Figure 79 above) and the air temperature and relative humidity sensor (2) with radiation shield are assembled to the QMA102M sensor arm at the factory. To mount the sensor arm to the logger tube, follow the procedure below:

1. Route the cable through the opening (3) inside the sensor arm.
2. Install the arm to the sensor arm support. Push the arm in place and tighten two hand screws (4).

Mounting Ultrasonic Wind Sensor

The ultrasonic wind sensor is mounted vertically to the Vaisala sensor adapter with the transducers facing up. To install the wind sensor to the mast with the sensor adapter, do the following (the numbers refer to Figure 80 on page 95):

1. Remove the mounting clamp (8) from the sensor adapter by loosening the bolt (4).
2. Route the cable through the opening (7) and through the sensor adapter (3). Leave the cable connector (6) outside the adapter.
3. Carefully remove the sensor from the container.
4. Install the bird spike on the top of the sensor.

CAUTION	Save the container and all the packaging materials. Always ship the Vaisala Ultrasonic Wind Sensor in its custom shipping container. Otherwise, you will void the warranty.

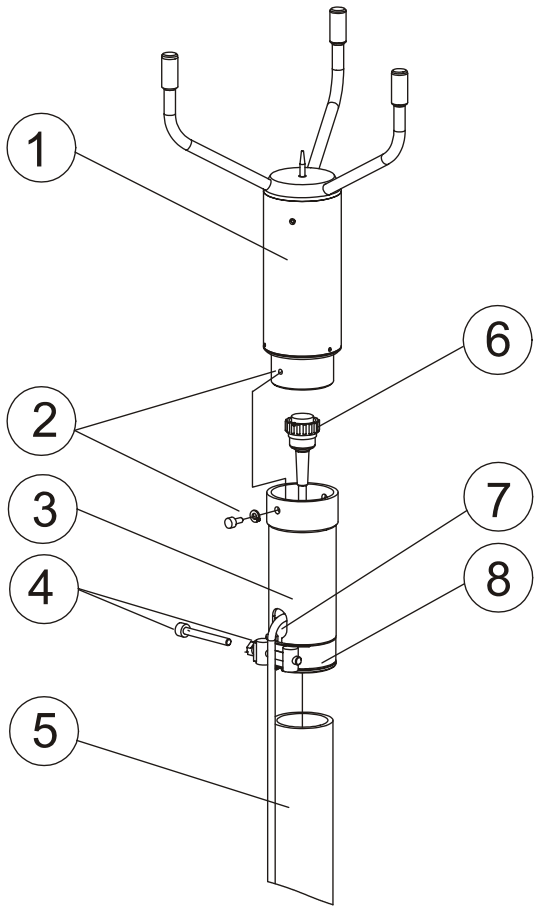

Figure 80 Installing Ultrasonic Wind Sensor

5. Remove the bolt (2) from the sensor body (1). Use the correct size Allen key or appropriate screw driver.
6. Connect the cable (6) to the sensor (1).
7. Attach the sensor adapter (3) to the sensor body (1). Insert and tighten the bolt (2) using the correct size Allen key or appropriate screw driver.
8. Reattach the mounting clamp (8) around the sensor adapter (3), but do not tighten the bolt (4) yet.
9. Tilt or lower the mast, if not already tilted.

NOTE	Do not remove the plastic cover from the end of the pole mast.

10. Attach the sensor adapter to the pole mast tube so that when the mast is erected, the transducer head marked with "N" is closely aligned for north and the transducer head marked with "S" is closely aligned for south. For more information, see Figure 82 on page 97. To make the alignment procedure easier, mark (for example, with paint or colored tape) the sensor body to indicate the north and south transducer heads so that you can easily see them from the ground.
11. Tighten the mounting clamp bolt using the correct size Allen key.
12. Erect the mast and check that the sensor is correctly aligned at the accuracy required for the intended use. The sensor is correctly aligned when the transducer heads are exactly in line with the compass pointing to true north or magnetic north. See Figure 81 below and Figure 82 on page 97.

    Wind direction can be referenced to either true north, which uses the earth's geographic meridians, or magnetic north, which is read with a magnetic compass. The magnetic declination is the difference in degrees between true north and magnetic north as presented in Figure 81 below.

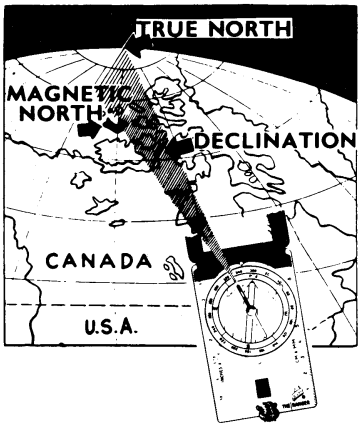

Figure 81 A Sketch of Magnetic Declination

NOTE	Your source for magnetic declination must be current because declination changes over time.

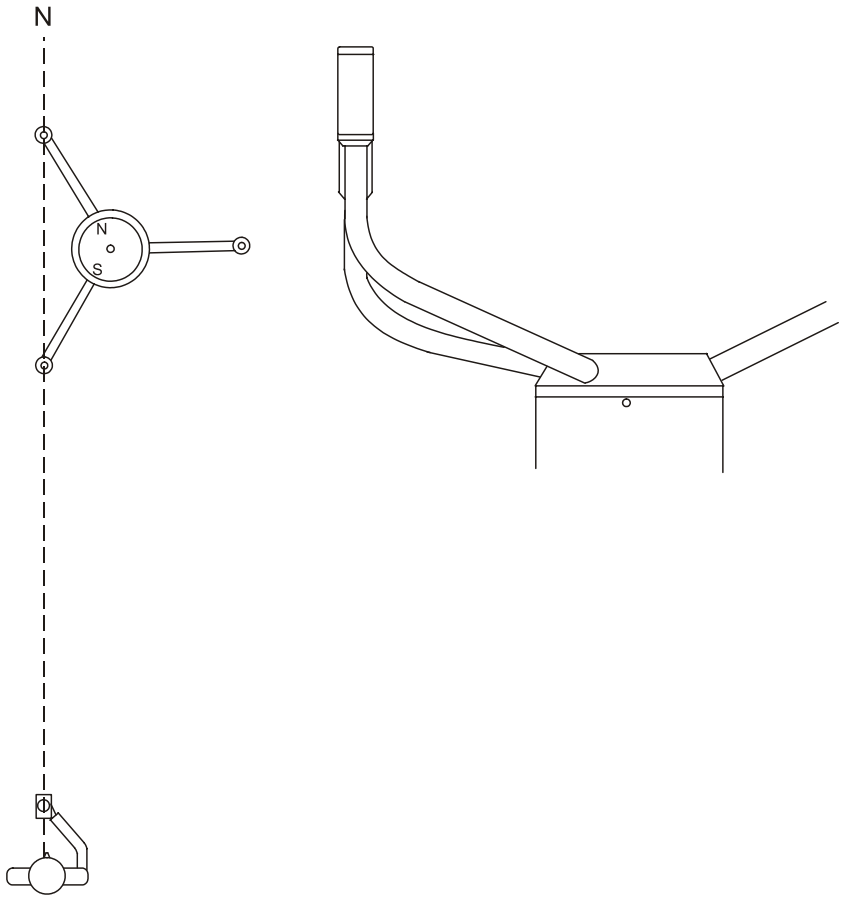

Figure 82 Correctly Aligned Ultrasonic Wind Sensor

a. Stand about 35 m to the south from the sensor with the compass pointing to north.

b. Use the compass to determine that the ultrasonic wind sensor's N-S transducer heads are exactly in line with the compass. If not, move left or right until the N-S heads are exactly in line with the compass. For the right position, see Figure 82 above.

c. If the alignment is not correct, lower the mast.

d. Loosen the mounting clamp at the bottom of the sensor adapter and rotate the sensor so that the heads marked with "N" and "S" are aligned to north and south when the mast is erected.

e. Tighten the mounting clamp.

f. Erect the mast to the vertical position and check the alignment again until the sensor is correctly aligned with the required accuracy.

WARNING To protect personnel and the wind sensor, a lightning rod must be installed with the tip several feet above the wind sensor. The rod must be properly grounded, compliant with all applicable safety regulations.

13. Attach the cables to the mast with the cable ties.
14. Connect the signal cable to the correct connector on the logger tube, see section Connecting Sensors to the Logger Tube on page 108.
15. Connect the DC power cable to the correct connector on QMP202MP, see section Connecting Sensors to QMP202MP on page 107.

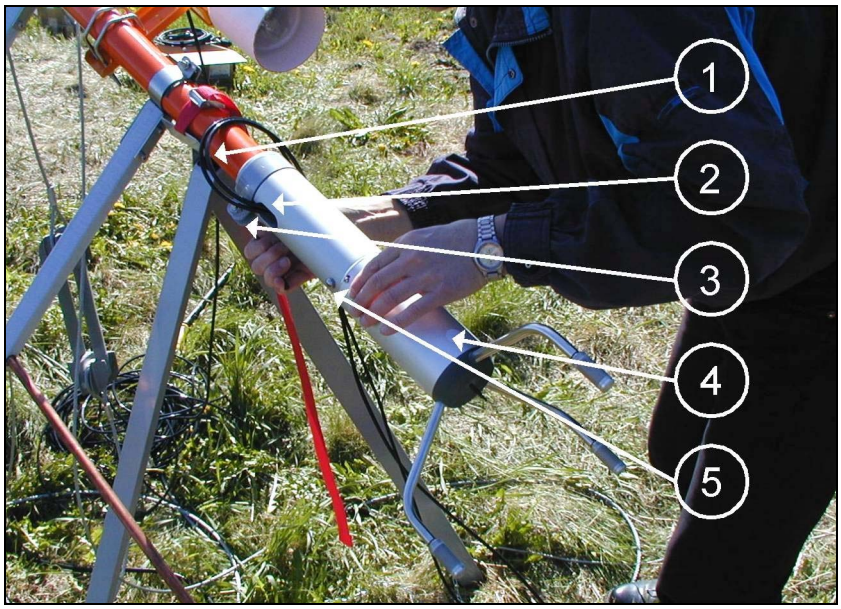

Figure 83 Ultrasonic Wind Sensor Mounted to the Mast

The following numbers refer to Figure 83 above:

1 = Cables
2 = Opening for the cables
3 = Mounting clamp
4 = Ultrasonic wind sensor
5 = Securing screw

Mounting the Sensor Arm

The sensor arm is installed to the mast to enable mounting of the lightning detector and the present weather sensor.

1. Install the sensor arm to the mast in the middle of the white area as illustrated in Figure 84 below. The height will then be approximately 3 m (10 ft) when the mast is erected.
2. Mount the sensor arm to the mast with the bracket (number 2 in Figure 84 below). The mounting piece for the lightning detector (1) must point up in the northern hemisphere.
3. Tighten the bracket properly after setting the sensor arm to east-west direction.

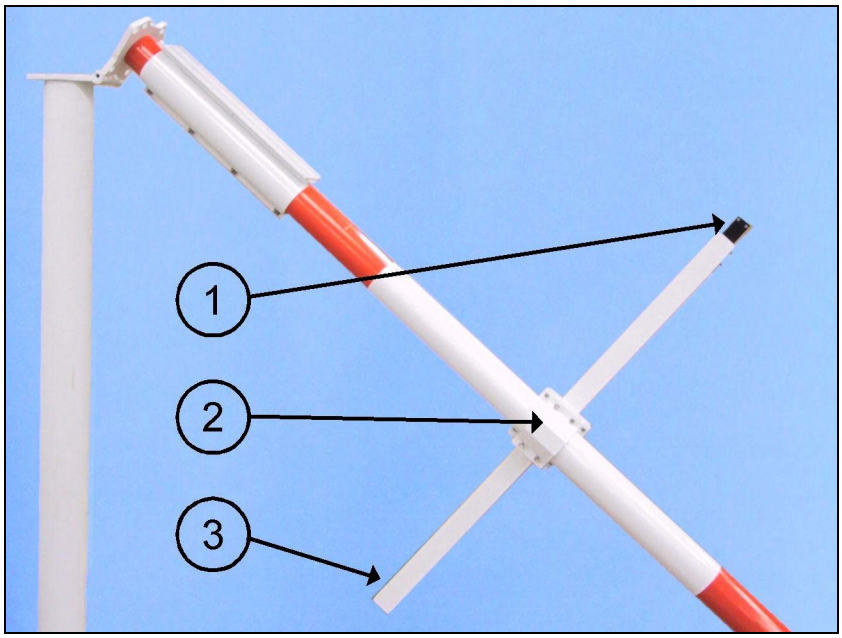

Figure 84 Sensor Arm Installation to the Mast

The following numbers refer to Figure 84 above.

1 = Mounting piece for the lightning detector
2 = Mounting bracket on the sensor arm
3 = Mounting notch for the present weather sensor

Mounting Present Weather Sensor

To install the Present Weather Sensor to the sensor arm that is installed to the mast, follow the procedure below:

CAUTION	Do not touch the rain detector plate. Take special care to prevent it from being hit. It is extremely fragile.

NOTE	Do not connect the power until the installation is completed.

1. Take the sensor from the shipping box.
2. Hold the sensor so that the hand screw is facing up, refer to Figure 85 below.
3. When the hand screw faces the notch (number 1 in Figure 85 below), push the sensor in place and tighten the hand screw (2).
4. Secure the installation with an Allen screw on the opposite side of the hand screw.

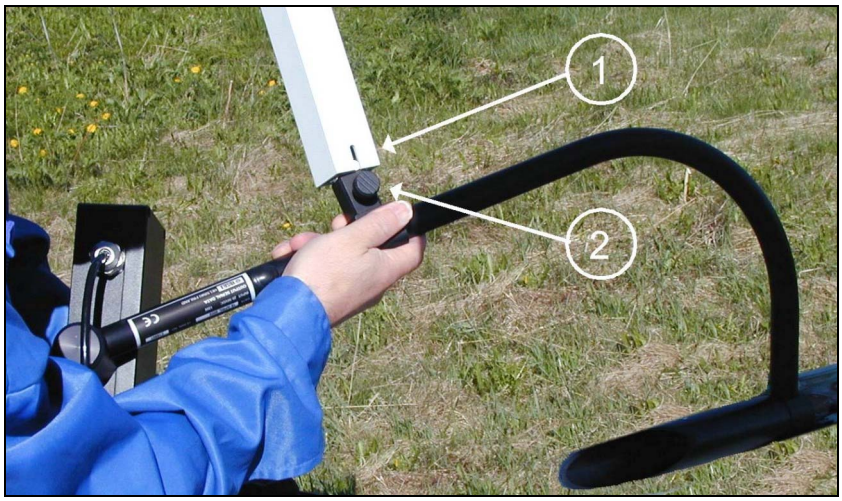

Figure 85 Installing Present Weather Sensor

5. Attach the cable to the mast with the cable ties.
6. Connect the DC power/signal cable to the correct connector on QMP202MP, see section Connecting Sensors to QMP202MP on page 107.

Mounting the Lightning Detector

To install the Lightning Detector to the sensor arm that is installed to the mast, follow the procedure below:

1. Attach the sensor (number 1 in Figure 88 on page 102) to the sensor arm (3) and tighten two bolts (2).

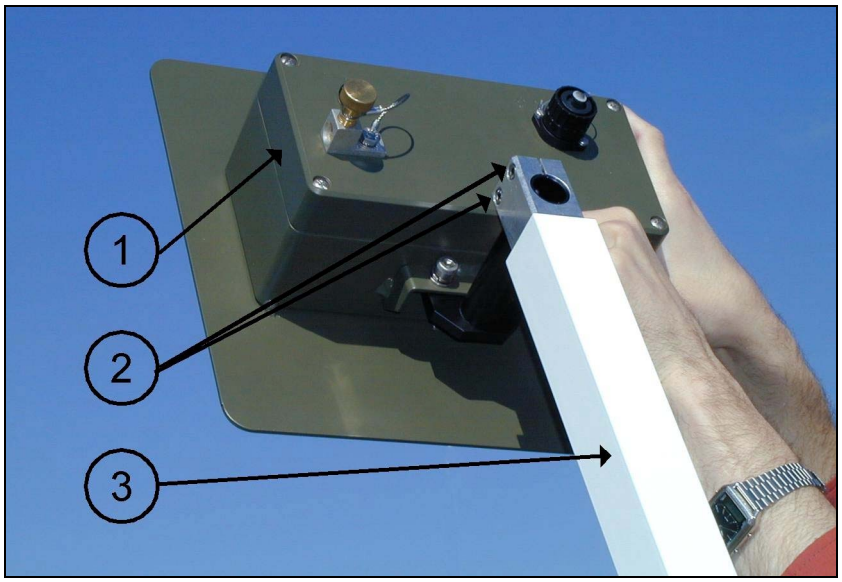

Figure 86 Mounting Lightning Detector

2. Connect the DC power/signal cable to the connector on SA20M, see Figure 87 on page 102 and the other end to the correct connector on the QMP202MP unit, see section Connecting Sensors to QMP202MP on page 107.

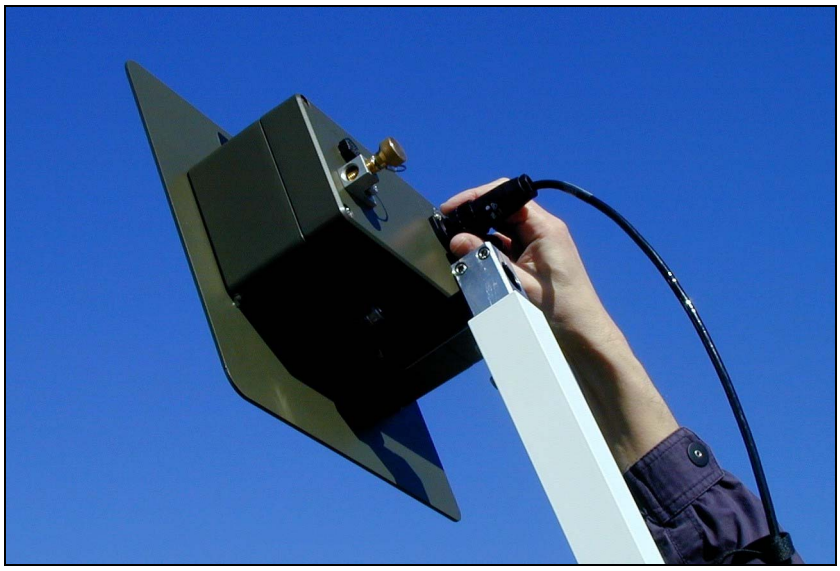

Figure 87 Connecting the Data Cable

3. Connect the provided grounding cable to the earth screw on the bottom of SA20M and secure with the finger screw, refer to Figure 88 below. The other end of the grounding cable is attached to the same grounding point as other equipment.
4. Attach the cables to the sensor arm and to the mast with the cable ties.

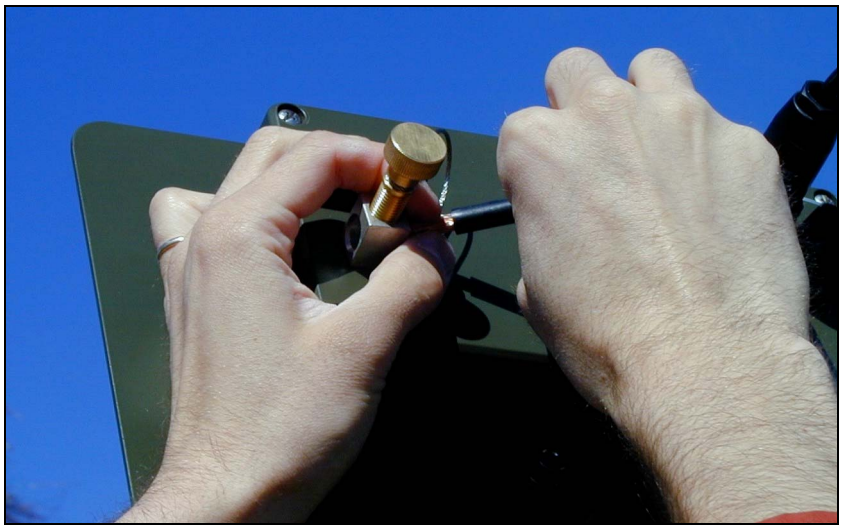

Figure 88 Connecting the Grounding Cable

5. Face the arrow (→ **N**) on the sensor plate to the magnetic north with the help of the compass.

NOTE	Do not place the compass on top of the unit while aligning, as this will cause erroneous readings.

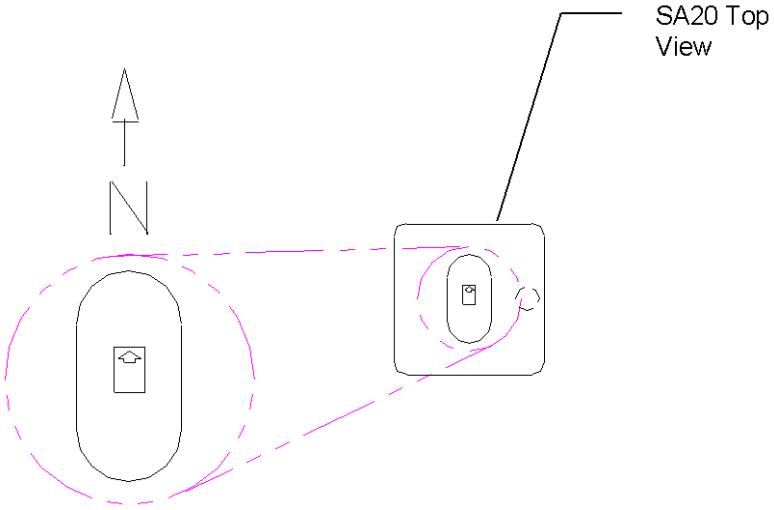

Figure 89 Lightning Detector Installed Facing Magnetic North

Mounting the Ceilometer

WARNING

The ceilometer is mounted to the ceilometer support that is attached to the mast. To mount the ceilometer onto the support, follow the procedure below:

1. Mount the ceilometer support to the mast with two brackets (number 1 in Figure 90 on page 104). Both brackets are secured to the mast with four bolts (2).
2. Measure that the distance between the upper end of the ceilometer support and the plate of the mast tube is approximately 450 mm (17.7 in.).

3. Align the ceilometer support north in the northern hemisphere (south in the southern hemisphere) to ensure that the optical window points away from the sun. To help the alignment, there is an arrow on the support.

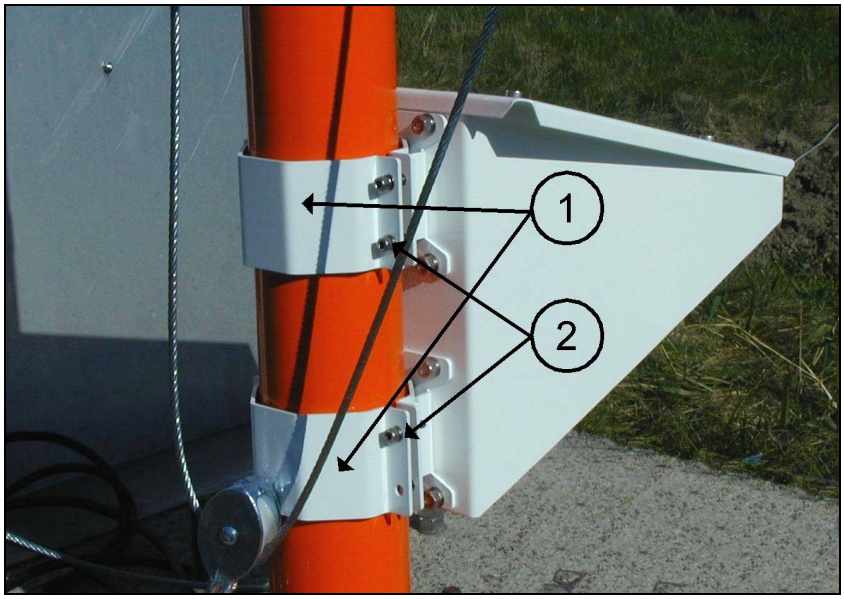

Figure 90 Installing the Ceilometer Support

4. Open the delivery box of the ceilometer. Lift the ceilometer using the handle of the unit and place it horizontally on the delivery box.
5. Loosen and remove the Allen bolts attaching the mounting bars on the support. Secure the mounting bars (number 1 in Figure 91 on page 105) to the legs of the ceilometer with the hand screws (3).
6. Install two Allen bolts without any washers to the two holes (number 4 in Figure 91 on page 105) nearest to the mast.
7. Place the ceilometer on the support arm so that the notches (2) meet the Allen bolts installed to the holes (4) of the support.
8. Install two Allen bolts with the washers to the lower holes of the support and tighten them properly.
9. Remove the Allen bolts installed in the holes nearest to the mast and reinstall them with the washers and tighten them properly.

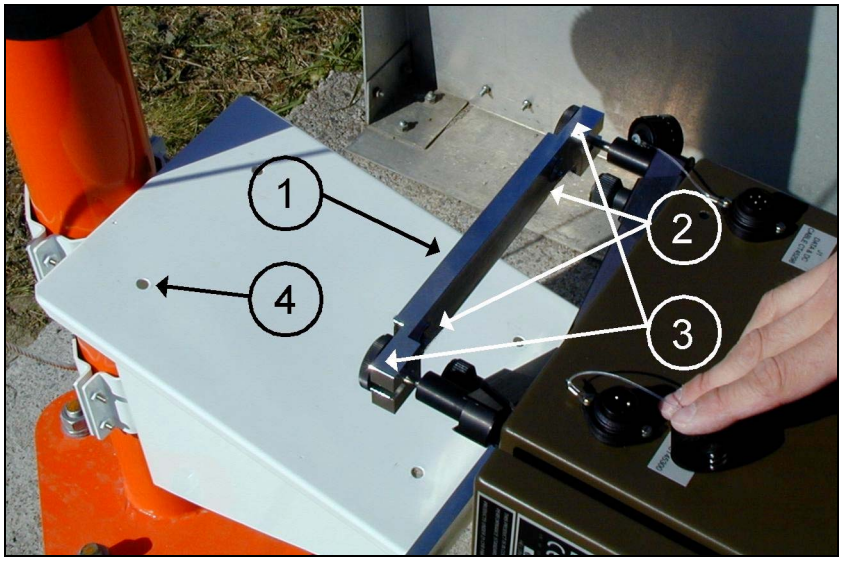

Figure 91 Installing the Ceilometer to the Support

10. Connect the DC/DATA cable to the connector **J1** on the ceilometer and the other end to the correct connector on the QMP202MP unit. Refer to Figure 92 below and section Connecting Sensors to QMP202MP on page 107.
11. Connect the AC (mains) cable to the connector **J2** on the ceilometer and the other end to the correct connector on the QMP202MP unit. Refer to Figure 92 below and section Connecting Sensors to QMP202MP on page 107.

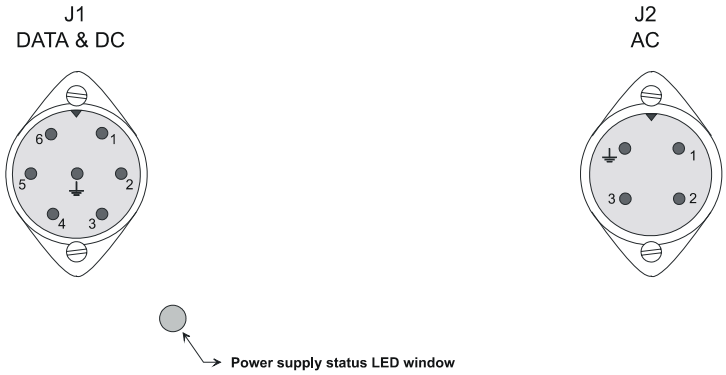

Figure 92 Connectors on the CT25KAM Ceilometer

12. Coil any excess slack of the cables and clamp them to the hooks under the support.
13. Attach the cables to the mast with the cable ties.
14. Verify the installation as instructed in section Verification on page 122.

Figure 93 CT25KAM Installed on the Ceilometer Support

Connecting the Cables

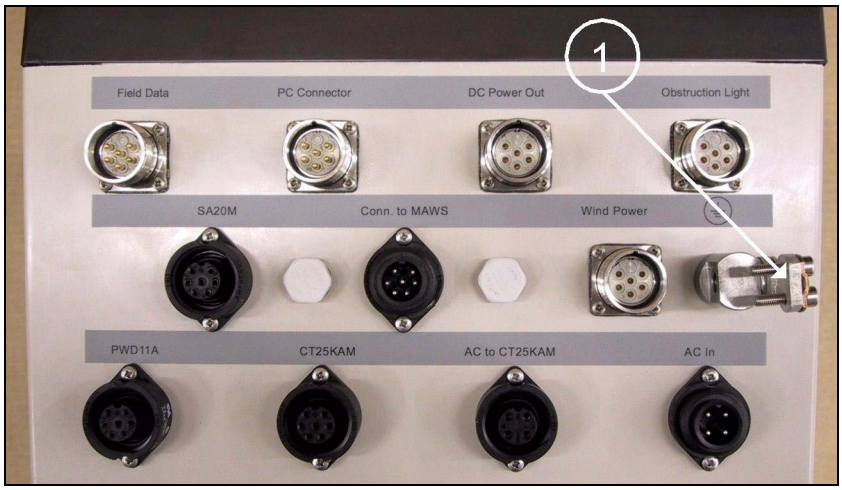

Figure 94 Connectors on the QMP202MP Unit

The following number refer to Figure 94 above::

1 = Grounding connector

WARNING A long cable between different units (sensors, transmitters, power supplies, and displays) can cause a life-threatening surge voltage, if a lightning strike occurs close by. Always ground the mast equipment case close to the mast with a short and low resistance cable.

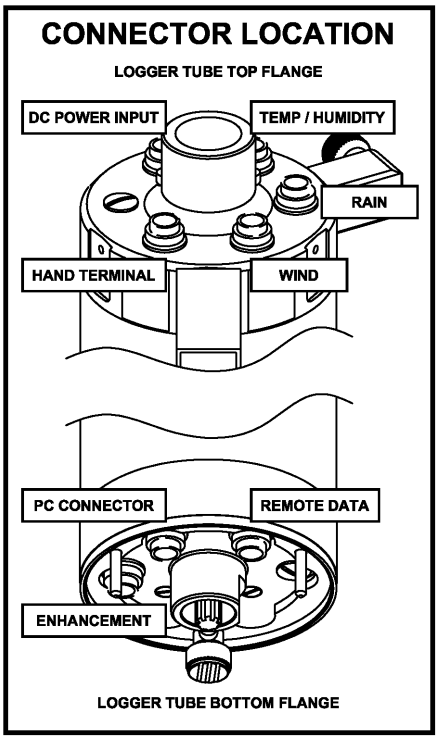

Figure 95 Connectors on the Logger Tube

Connecting Sensors to QMP202MP

The sensors and the applicable cables that are connected between the sensor and the QMP202MP unit are listed in Table 4 below.

Table 4 Sensors, Cables, and the Connectors on QMP202MP

Sensor	Cable	Connector on QMP202MP
Present Weather Detector PWD11A	Connected to sensor	PWD11A
Ceilometer CT25KAM	CT45298	CT25KAM
	CT45300	AC to CT25KAM
Lightning Detector SA20M	ZZ45215	SA20M
Ultrasonic Wind Sensor WS425	ZZ212024	Wind Power

Connecting Sensors to the Logger Tube

The sensors and the applicable cables that are connected to the upper plate of the logger tube are listed in Table 5 below.

Table 5 Sensors, Cables, and the Connectors on QME101M

Sensor	Cable	Connector on Logger Tube
Rain Gauge QMR101M	Connected to sensor	**Rain**, blue connector on the upper base
Air Temperature and Relative Humidity SensorQMH101M	Connected to sensor	**Temp/Humidity**, red connector on the upper base
Ultrasonic Wind Sensor WS425	ZZ212024	**Wind**, white connector on the upper base

Connecting Logger Tube to QMP202MP

Three cables should be connected between the logger tube and QMP202MP as follows:

1. Connect the input data cable (ZZ45123) between the connector **Enhancement** that is marked with a green arrow at the lower base and the connector **Conn. to MAWS** on the QMP202MP unit.
2. Connect the power cable (ZZ212025) between the connector **DC Power Input** that is marked with a green arrow on the upper base of the logger tube and the connector **DC Power Out** on the QMP202MP unit.
3. Connect the output data cable (ZZ212026) between the connector **PC Connector** that is marked with a yellow arrow on the lower base of the logger tube and the connector **PC Connector** on the QMP202MP unit.

Connecting AC Power to QMP202MP

The **AC In** connector at the bottom of the QMP202MP unit is connected either through QPS101 Power Strip to the AC (mains)

outlet or to the AC (mains) outlet directly with the customer's own cable. When you use QPS101, follow the procedure below:

1. Connect QPS101 Power Strip to the AC (mains) outlet.
2. Connect the AC (mains) cable between the QMP202MP **AC In** connector and the QPS101 Power Strip.
3. Secure the cable to the mast with the cable ties.

Connecting the Grounding Cable to QMP202MP

The grounding cable is connected to the **Grounding** clamp (number 1 in Figure 94 on page 106) on the QMP202MP unit. To connect the grounding cable to QMP202MP, follow the procedure below:

1. Strip 25 mm (1 in.) of the cable sheath at both ends of the grounding cable. The grounding cable for QMP202MP can be obtained by first cutting the cable of the lightning rod to the correct length. The rest of the cable, that is, approximately 2 m (6.6 ft) can be used for grounding QMP202MP.
2. Connect the cable to the **Grounding** clamp (number 1 in Figure 94 on page 106). Avoid bending the cable.
3. Fix the grounding cable to the pedestal tube with cable ties.
4. To connect the other end of the grounding cable, refer to section Equipment Grounding on page 80.

Connecting Communication Cable to QMP202MP

The communication cable is connected to the **Field data** connector on the QMP202MP unit.

Securing and Protecting the Cables

After you have connected the cables from the sensors to the QMP202MP unit, secure all the cables to the mast with cable ties, refer to Figure 96 below.

Figure 96 Securing Cables to the Mast

Near the hinge you should protect the cables with the provided spiral to avoid possible damages to cables when the mast is tilted and erected. The spiral can be installed around the cables by hand or with an optional tool as illustrated in Figure 97 below.

Figure 97 Protecting Cables with Spiral

Storing the Tools for Future Use

A tool bag is to be installed to the arm fixture of the logger tube. Store all the provided tools in a tool bag , that is, key for the QMP202MP enclosure, the Allen keys, screwdriver, and the adjustable wrench.

Connecting and Placing the Handheld Terminal to the Logger Tube

Connect the handheld terminal cable to the **Hand Terminal** connector on the upper base of the logger tube. The connector is marked with a yellow arrow as shown in Figure 98 below. Place the handheld terminal to the holder that is installed in front of the tool bag to the arm fixture of the logger tube.

NOTE	To ensure faultless operation of the handheld terminal, you should remove the handheld terminal from the holder and store it indoors in the harsh weather conditions, for example, in cold climate.

Figure 98 Connecting the Handheld Terminal

Installations inside QMP202MP

Normally all devices inside the QMP202MP unit are fully installed at the factory, and there is no need to open the door of the enclosure.

Installing Optional Radio Communication

NOTE	The radio modem in your system may differ from the one shown in the figures of this section.

Mounting the Antenna to the Mast

For mounting the antenna, select a desired height (preferably as high as possible). The antenna arm must be attached to the mast with a diameter of 75 mm (2.95 in.).

NOTE	Align the antennas so that there will be a line of sight between the station antenna and the remote antenna.

1. Attach the mounting piece (number 1 in Figure 99 below) to the mast.

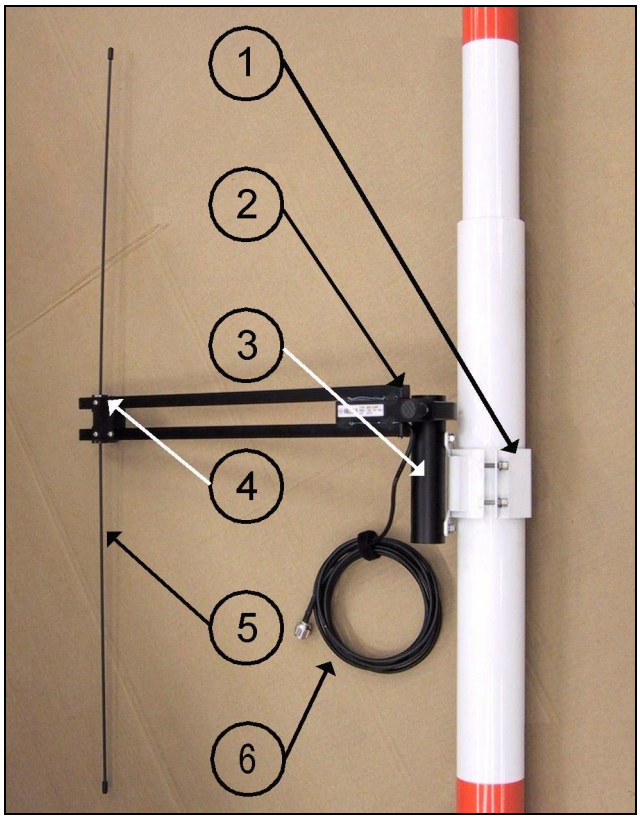

Figure 99 VHF Antenna Mounted on the Mast

2. When you are installing a VHF antenna:
   a. Assemble the hook of the antenna arm around the tube (number 3 in Figure 99 on page 112) on the mounting piece.
   b. Secure the antenna arm with the hand screw (2).
   c. Open the two hand screws (4) and turn the antennas (5) according to Figure 99 on page 112.
   d. Close the two hand screws (4) to secure the antennas.
3. When you are installing an UHF antenna:
   a. Insert four ground plane elements (number 1 in Figure 100 below) and the radiator (3) to the antenna base (2) by screwing them clockwise.

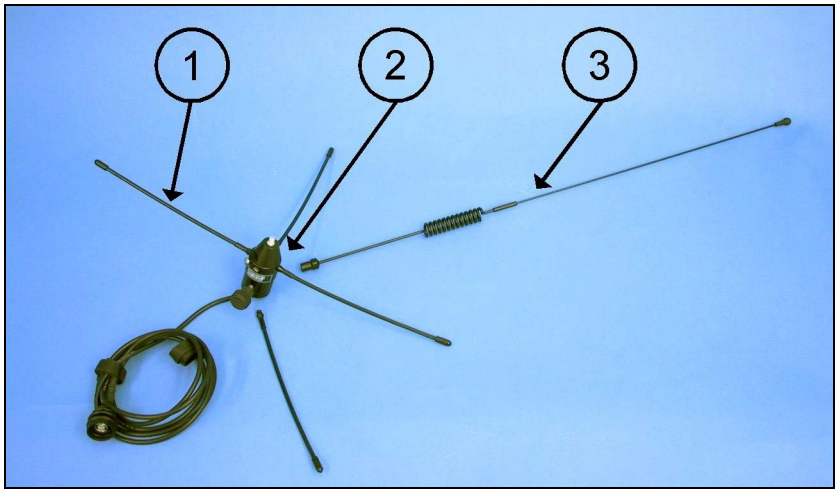

Figure 100 UHF Antenna Assembly

   b. Assemble the hook of the antenna arm around the tube (number 3 in Figure 101 on page 114) on the mounting piece. The notch (4) at the end of the arm must face up.
   c. Secure the antenna arm with the hand screw (2).
   d. Mount the antenna (5) to the antenna arm and secure with the hand screw.

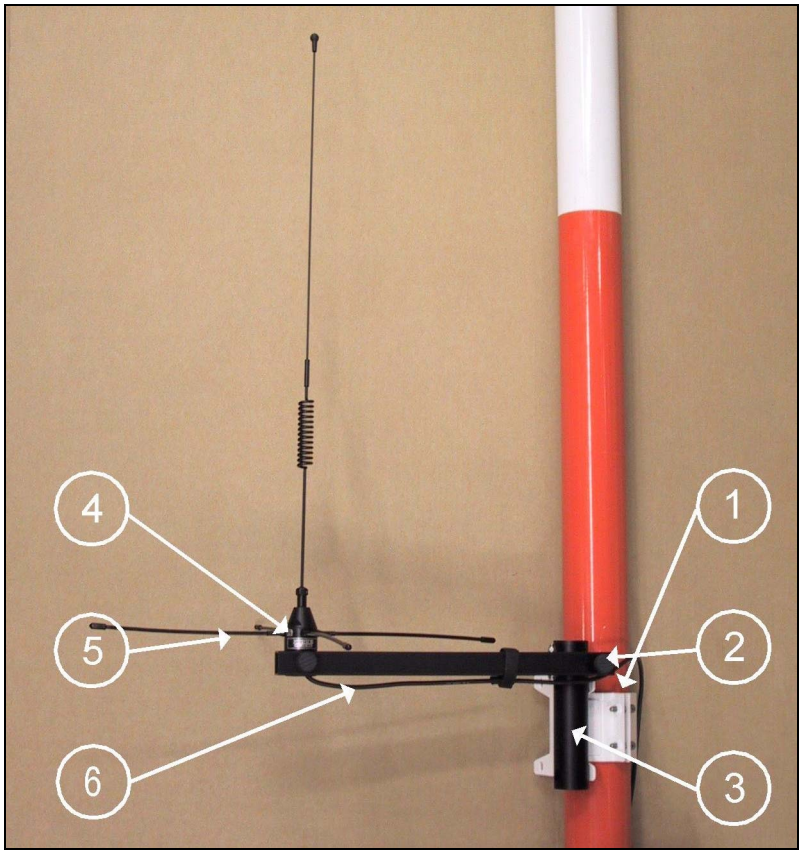

Figure 101 UHF Antenna Mounted on the Mast

4. Check that the antenna is not over rain gauge (QMR101M) or present weather detector (PWD11A) when the mast is erected.
5. Attach the cable (number 6 in Figure 99 on page 112 or in Figure 101 above) to the mast with the cable ties.
6. Connect the cable to the correct connector on the radio, see section Installing a Radio Modem to the Sensor Arm on page 120.

Configuring the Radio Modems

NOTE	This section applies only to the radio modem models TM32 and RFM96W delivered by Vaisala.

Before installing a radio modem to the sensor arm or to the tripod, you need to configure the radio modems. It is most convenient to configure both radios in a row once you have stopped the MIDAS IV software. The radio modem configuration consists of two steps:

1. Setting up the radio modems.
   - Entering owner information
   - Setting channel frequencies
   - Setting communications parameters
   - Entering radio link settings.
2. Selecting the active channel.

Owner information, active channel, and channel frequencies are mission dependent. For the rest of the settings, use the values presented in Table 6 on page 118 and Figure 104 on page 117.

WARNING	Do not operate the radio modem near electrical blasting caps or in an explosive atmosphere.

CAUTION	Improper setup of the radio modem may damage the unit.

CAUTION	Do not operate the radio modem unless all RF connectors are secure and any open connectors are properly terminated.

NOTE	Before deployment, the radio modems must be configured.

Setting Up the Radio Modems

The radio modem settings are done with the PC/DOS software RFMCONFD that is installed on the MIDAS IV PC. The program is started in the **TACMET Configuration Wizard** window.

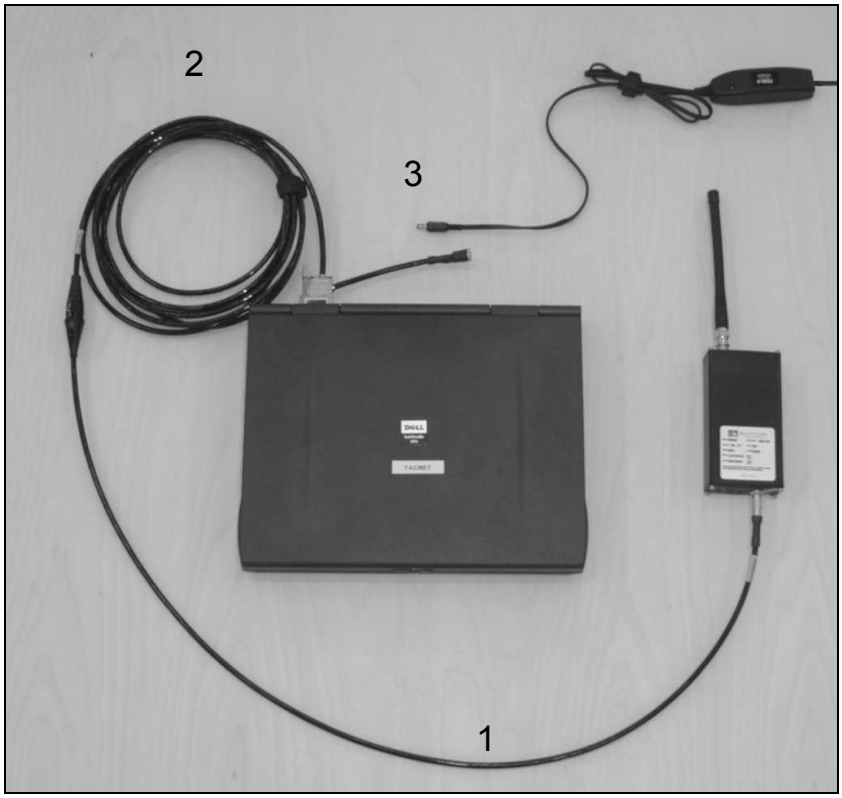

Figure 102 Connecting a Radio Modem to a PC for Configuration

1. Disconnect the radio modem from outdoors, if already installed, and place it near the MIDAS IV PC.
2. Shut all MIDAS IV programs on the MIDAS IV PC, and when applicable disconnect the MIDAS IV PC from the QCA101 unit.
3. Connect the PC cable (number 2 in Figure 102 above) between the PC and the radio modem, which has the data/power cable (number 1 in Figure 102 above) connected.

NOTE Do not connect the QMP211 power supply (number 3 in Figure 102 above) to the power supply connector at the PC end of the landline cable (2), until the configuration software prompts you to supply power to the radio modem.

4. Click the **Radio Modem** button in the **TACMET Configuration Wizard** window to start the configuration software.
5. Enlarge the appearing window by pressing ALT+ENTER.
6. Click the **OK** button.

7. In the **Configure** menu, select **Load**.
8. Follow the instructions on the screen to select the appropriate COM port (usually COM1) and to connect the power supply when asked to.
9. When the **Model information** window appears, click the **OK** button to proceed.

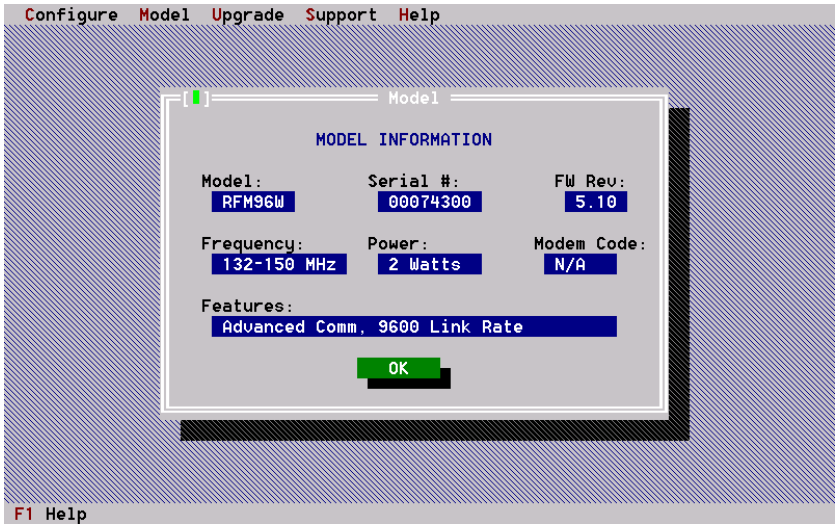

Figure 103 Model Information Window

10. To set the radio modem configuration, select **Configure - Settings**. For the correct settings, refer to Table 6 on page 118 and Figure 104 below. Finally, to approve the settings, click the **OK** button.

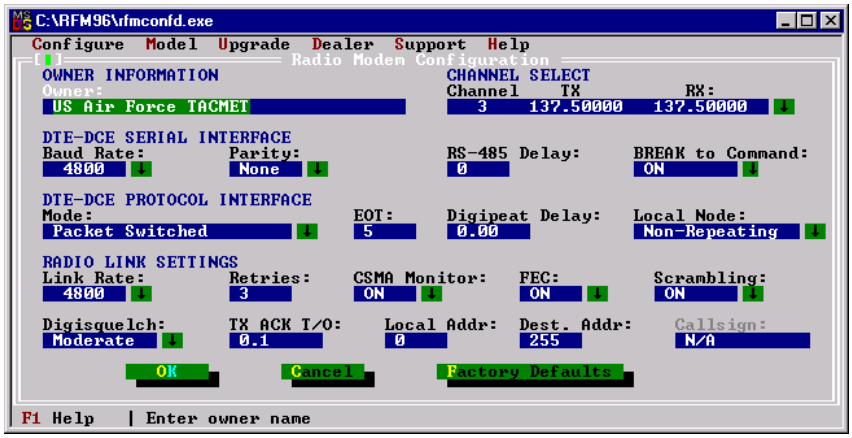

Figure 104 Radio Modem Settings

Table 6 Radio Modem Settings

Value	Setting
Baud Rate	4800
Parity	None
RS-485 Delay	0
Break to Command	ON
Mode	Packet Switched
EOT	5
Digipeater Delay	0.00
Local Node	Non-Repeating
Link Rate	4800
Retries	3
CSMA Monitor	ON
FEC	ON
Scrambling	ON
Digisquelch	Moderate
TX ACK T/O	0.1
Local Addr	0
Dest. Addr	255

11. To specify channel frequencies, select **Dealer - Customer Configure**, refer to Figure 105 below.

    a. Under **Diskette Type**, select **Channel Table Upgrade**.

    b. Add new frequencies.

    c. Finally, click the **OK** button.

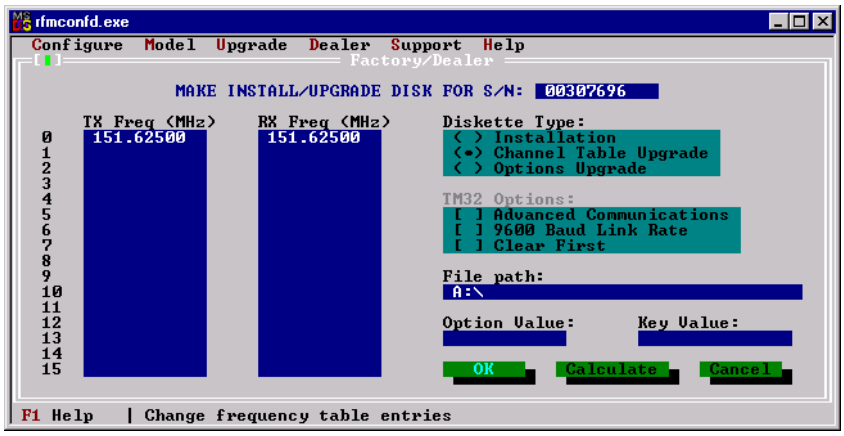

Figure 105 Configuring Channel Frequencies

12. To save the information to the memory of the radio modem, select **Configure - Program**.

13. After you have finalized the radio modem originating from outdoors, connect the MIDAS IV PC to the radio modem originating from indoors and start the procedure again from step 3.

14. To select the active channel, follow the instructions given in section Selecting the Active Channel below.

Selecting the Active Channel

For the radio modem that is installed outdoors, the active channel is selected with the handheld terminal. For the radio modem that is installed indoors the active channel is selected with the RFMCONFD software.

NOTE	Both radio modem units must be configured to use the same set of channel frequencies before selecting the active channel.

Radio Modem Outdoors

NOTE	Before selecting the active channel for the radio modem, you have to mount the radio modem to the sensor arm and connect the cables, as instructed in section Installing a Radio Modem to the Sensor Arm on page 120.

Follow the procedure below to set the active channel with the handheld terminal:

1. Connect the handheld terminal to the **Hand Terminal** connector on the upper base of the logger tube. The connector is marked with a yellow arrow.
2. In the handheld terminal, select the **Setup** window. For detailed instructions, refer to the MAWS201MP User's Guide.
3. Change value for **Rf-PC** to the desired channel.

Radio Modem Indoors

Follow the procedure below to select the active channel with the RFMCONFD software:

1. Shut down all MIDAS IV programs on the MIDAS IV PC.
2. Click the **Radio Modem** button in the **TACMET Configuration Wizard** window to start the configuration software.
3. Enlarge the window by pressing ALT+ENTER.
4. In the **Configure** menu, select **Load**.

5. Follow the instructions on the screen to select the appropriate COM port (usually COM1) and to connect the power supply when asked to.
6. When the **Model information** window appears, click the **OK** button to proceed.
7. To set the active channel, select **Configure - Settings**.
8. Under **Channel Select**, open the list of the channels by clicking the green arrow. Refer to Figure 106 below.

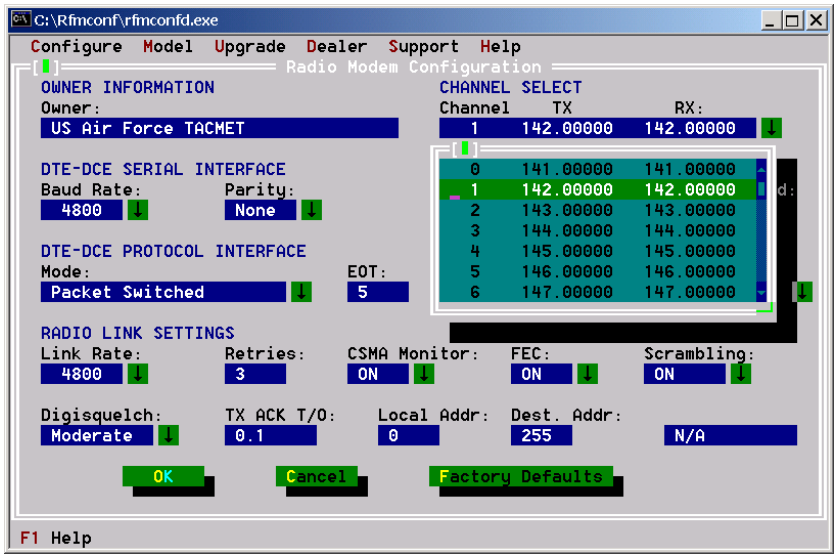

Figure 106 List of the Active Channels

9. From the list, double-click the desired channel to activate it.
10. Click the **OK** button.
11. To save the information to the memory of the radio modem, select **Configure - Program**.

Installing a Radio Modem to the Sensor Arm

Follow the procedure below to mount the radio modem to the sensor arm and to connect the cables to a radio modem:

1. Install a radio modem (number 1 in Figure 107 on page 121) on the sensor arm (3) that is equipped with an adapter (2). Just slide the radio modem downward to the adapter.

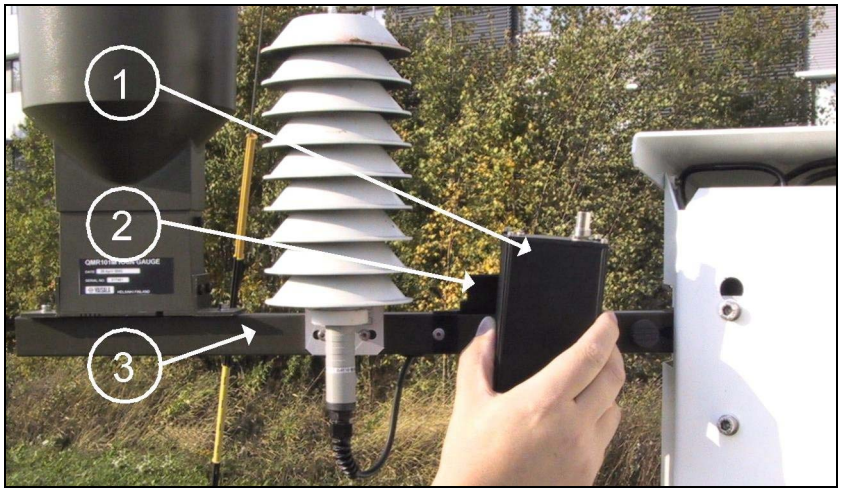

Figure 107 Installing a Radio Modem to Sensor Arm

1. Connect the data/power cable (number 3 in Figure 108 below) to the radio modem (2), and lead the cable through the opening (1) in the radiation shield.
2. Connect the other end of the cable to the **PC Connector** at the bottom flange of the logger tube. For the location of the connector, see Figure 95 on page 107.

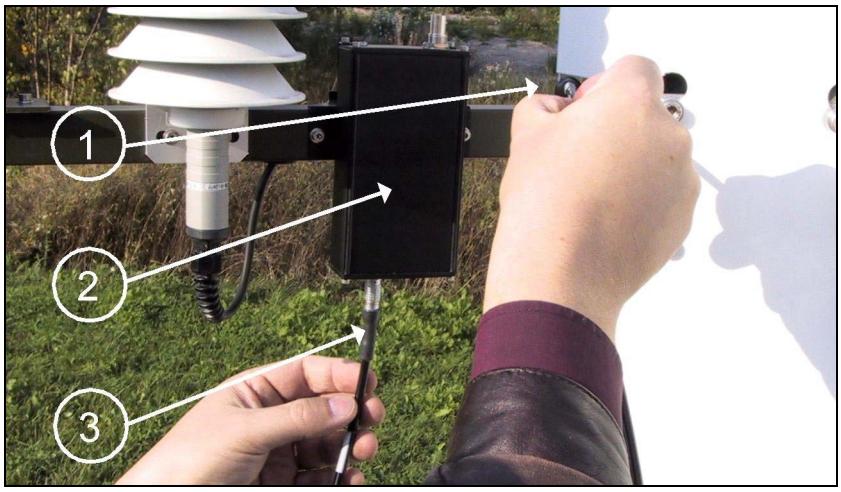

Figure 108 Connecting the Data/Power Cable between a Radio Modem and Logger Tube

3. Connect the antenna cable (number 1 in Figure 109 on page 122) to the BNC connector (2) on a radio modem (3).

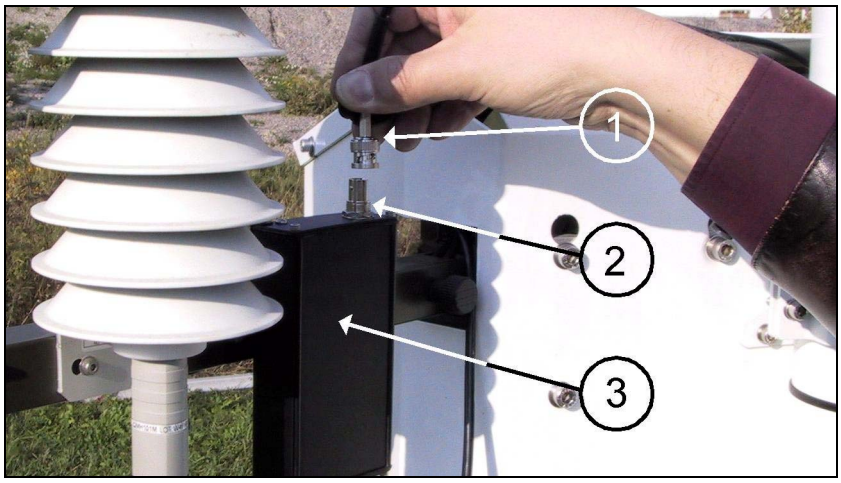

Figure 109 Connecting the Antenna Cable

Verification

To verify the system, power it up:

1. Connect the battery connector inside QMP202MP.
2. Connect the AC cable to power outlet.
3. Turn the power switch ON inside QMP202MP.

Ceilometer CT25KAM

After switching the AC (mains) power on, you can verify the operation of CT25KAM Ceilometer with the status LED, see Table 7 below.

Table 7 States of the Status LED in CT25KAM

State	Explanation
Red	Only the AC cable is connected.
Green	Only the DATA&DC cable is connected.
Blinking from green to red	Both cables are connected, indicating that the operating voltage and mains power are available.
Red	Both cables are connected and the internal heating is on (likely after start up).

Lightning Detector SA20M

SA20M will send a message to the handheld terminal if the siting is unsuccessful.

WT501 Equipped with DMX501

If you do not receive data to MIDAS IV PC, open the door of the QMP202MP enclosure and check that the green light blinks on the transmitter.

Radio Modem

Confirm by checking the LEDs of the modem that the modem is powered and it is sending and receiving data.

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CHAPTER 5

INSTALLING INDOOR COMPONENTS

This chapter provides you information that is needed in installing the MIDAS IV workstation and QCA101 Communication Accessory Enclosure indoors.

Installing MIDAS IV Software

System Requirements

Minimum system requirements for the MIDAS IV PC are listed in Table 8 below.

Table 8 Minimum System Requirements

Component	Minimum Requirement
PC	500 MHz
Operating System	Windows 2000 1)
Memory	128 MB RAM
Hard Disk Space	200 MB 2)
File System	NTFS
Drives	CD-ROM Drive
Serial Ports	1 free serial port
System Time	GMT/UTC time

1) With Service Pack 3
2) Minimum installation requires 50 MB hard disk space

Installation Procedure

NOTE	Usually you will not need to install the MIDAS IV software, as it is already installed at Vaisala. When the MIDAS IV software is launched in the Windows startup automatically, you can proceed to section MIDAS IV TACMET Configuration on page 127.

To install MIDAS IV Software and all the necessary accessories, follow the procedure below:

1. Start the MIDAS IV PC and log in as Administrator, or with the profile having equivalent rights.
2. Check that the system uses GMT/UTC time. You can set the time in **Start** - **Settings** - **Control Panel** - **Date**/**Time** - **Time Zone** by selecting (**GMT**) **Casablanca**, **Monrovia**.
3. Check that the file system of the C:\ drive is NTFS with **Start** - **Settings** - **Control Panel** -**Administrative Tools** - **Computer Management** - **Storage** - **Disk Management**. If it is FAT file system, you will need to convert it to NTFS. In the **Start** menu, click **Run** and type **convert c: /FS:NTFS**.
4. Check with **Start** - **Settings** - **Control Panel** - **Administrative Tools** - **Services** that your computer has TCP/IP protocol installed. The MIDAS IV software will not function without TCP/IP.
5. Turn off the Plug and Play service. Go to **Start** - **Settings** - **Control Panel** - **Administrative Tools** - **Services**. Select **Plug and Play**, right-click it and select **Properties**. In **Startup type**, select **Disabled**, and click the **OK** button.
6. Run the Installation Wizard from a CD drive (e: is assumed as a CD drive) **e:\setup.exe**. Double-click the file to run it. Follow the instructions on the screen and click **Next** in all prompts.
7. Click **Finish** to complete the setup and restart the computer. After the installation is finished, you will have new shortcuts on the desktop: **Configuration Wizard**, **Weather view**, **Event Monitor**, **MIDAS IV Tacmet**, and **METAR Template**. These will also be located under **Start** - **Programs** - **MIDASIV Tacmet**.

MIDAS IV TACMET Configuration

Double-click the **Configuration Wizard** icon on the desktop to open the configuration window.

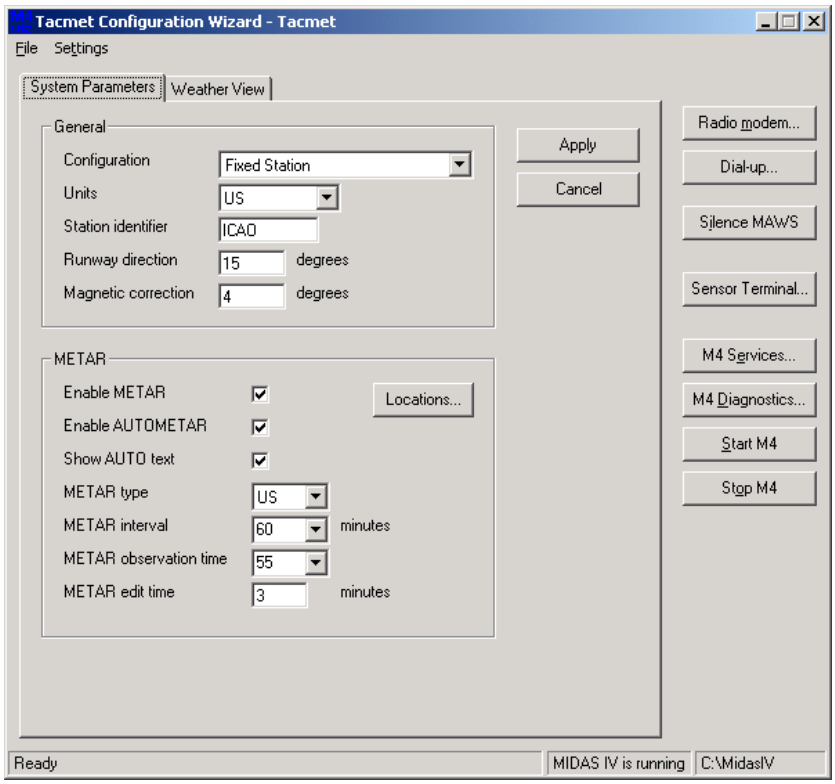

Figure 110 Configuration Wizard

The Configuration Wizard includes two menus: **File** and **Settings**. From the **File** menu, you can browse log files, exit Configuration Wizard or read the version information. The **Settings** menu has two menu items: **Radio modem** and **Dial-up**.

The **Radio modem** sub-menu has three items: **Use radio modem**, **Radio modem channel**, and **Configuration software**. **Use radio modem** -item is used to enable/disable radio modem. **Radio modem channel** -item is used to select the pre-configured radio channel. **Configuration software** -item is used to select an application for configuration of the radio modem.

The optional **Dial-up** sub-menu has two items: **Use Dial-up** and **Configuration software**. **Use Dial-up**-item is used to enable/disable dial-up connection, for example, satellite connection. **Configuration software** -item is used to select an application for configuration of the dial-up connection.

Table 9 below explains the Configuration Wizard Buttons.

Table 9 Explanation of Configuration Wizard Buttons

Button	Explanation
Radio Modem	Opens Radio Modem Configuration program
Dial-up	Opens optional Dial-Up Manager
Silence MAWS/ Enable MAWS	Silences MAWS Asks which radio channel to use and then enables MAWS
Sensor Terminal	Opens Sensor Terminal application
M4 Services	Opens MIDAS IV Service Manager
M4 Diagnostics	Opens ROA Diagnostics Monitor
Start M4	Starts MIDAS IV applications
Stop M4	Stops MIDAS IV applications
Apply	Accepts configuration changes
Cancel	Cancels configuration changes
Locations...	Opens METAR/SPECI Manager application

System Parameters Tab

From the **System Parameters** tab (see Figure 110 on page 127), you can configure the parameters described in Table 10 below and Table 11 on page 129.

Table 10 Explanation of System Parameters Tab: General Frame

Item	Description
Configuration	Select your system configuration: 1 Basic station, 1 Enhancement station, Basic and Basic stations, Enhancement and Basic stations, Enhancement and Enhancement stations, or Fixed Station.
Units	Select the units you want to use: SI or US.
Station identifier	The unique ICAO identifier with 4 characters when the METAR message is sent to AFTN. Otherwise, give the station ID, for example, airfield name.
Runway direction	Give the Runway direction in degrees.
Magnetic correction	Give the difference between magnetic north and true north.

Table 11 Explanation of System Parameters Tab: METAR Frame

Item	Description
Enable METAR	Check only if you want the system to generate METAR/SPECI messages.
Enable AUTOMETAR	Check only if you want to enable automatic METAR/SPECI sending feature.
Show AUTO text	Check only if you want the AUTO text to appear in the header of METAR/SPECI message.
METAR type	Select METAR/SPECI type: US or ICAO
METAR interval	Select METAR/SPECI sending interval in minutes: 30 or 60.
METAR observation time	Select METAR/SPECI editing start time: 00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, or 55 minutes past the hour.
METAR edit time	Select the desired METAR/SPECI editing time in minutes, for example 3.

Weather View Tab

With the Weather View tab, you can configure the amount and the order of the displays in Weather View.

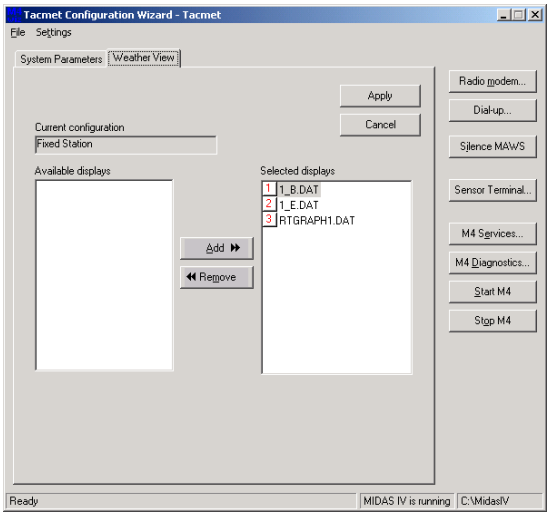

Figure 111 Weather View Tab

NOTE Normally there is no need to modify the display settings.

QCA101 Communication Module Installation

Always install the communication module indoors as close to the MIDAS IV PC as possible. That is to ensure trouble-free data transfer via the RS-232 line to the MIDAS IV PC.

NOTE	All the connections inside the QCA101 unit are made at the factory. Normally there is no need to open the QCA101 unit during installation.

Connecting the Cables to QCA101

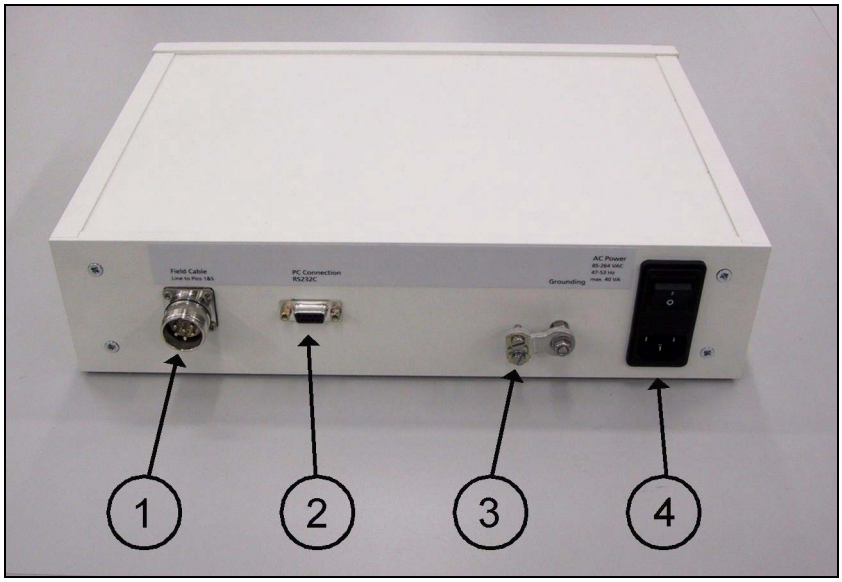

Figure 112 Connectors on the Back of the QCA101 Unit

The following numbers refer to Figure 112 above.

1 = Field data from MAWS
2 = RS-232 connection to MIDAS IV PC
3 = Grounding connector for additional grounding cable
4 = AC (mains) input

AC (Mains) Power

AC (mains) power is connected through the AC (mains) switch as follows:

1. Make sure that the AC (mains) switch is off.
2. Connect the power cord to the **Power** connector on the back of the QCA101 unit.
3. Plug the power cord into a properly grounded electrical outlet.
4. Do not switch the power on until you have connected the data and antenna cables.

Grounding

If additional grounding is required, for example, due to insufficient grounding of the electrical network, connect the extra grounding cable to the **Grounding** connector on the QCA101 unit. The need for additional grounding is case-specific and all the accessories for the grounding must be supplied locally.

RS-232 Connection to MIDAS IV PC

Connect the provided RS-232 cable labeled with **PC** and **QCA101** between the QCA101 unit and MIDAS IV PC as follows:

1. Connect the cable end with **PC** label to MIDAS IV PC and secure with the screws.
2. Connect the other end of the cable to the QCA101 unit and secure with the screws.

Communication Connection to the QCA101 Unit

The communication connection (landline connection) for the modem uses a twisted pair cable. The cable is connected to the **Field cable** connector.

Installing Optional Radio Communication

CAUTION	Only operate the radio modem with the antenna or appropriate substitute (dummy load) connected.

NOTE	The radio modem in your system may differ from the one shown in the figures of this section.

Follow the procedure below to set up and connect the radio modem to MIDAS IV PC:

1. Before installing the radio modem to the tripod, select the same channel as in the outdoors radio modem attached to the sensor arm. Refer to section Selecting the Active Channel on page 119. For the cable connections, refer to Figure 102 on page 116.
2. When you use a VHF antenna, you must use an antenna adapter with the antenna tripod to attach the antenna to the tripod, see Figure 113 below.

Figure 113 VHF Antenna in Tripod

3. When you use an UHF antenna, install the assembled antenna directly on the top of the tripod, see Figure 114 below.

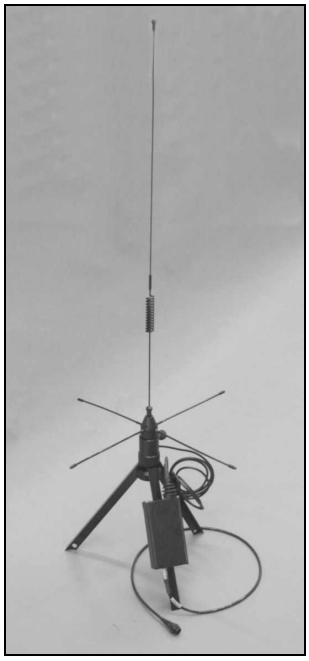

Figure 114 UHF Antenna in Tripod

4. Place the correctly configured radio modem (number 4 in Figure 115 below) to the adapter that is mounted on the leg of the tripod.

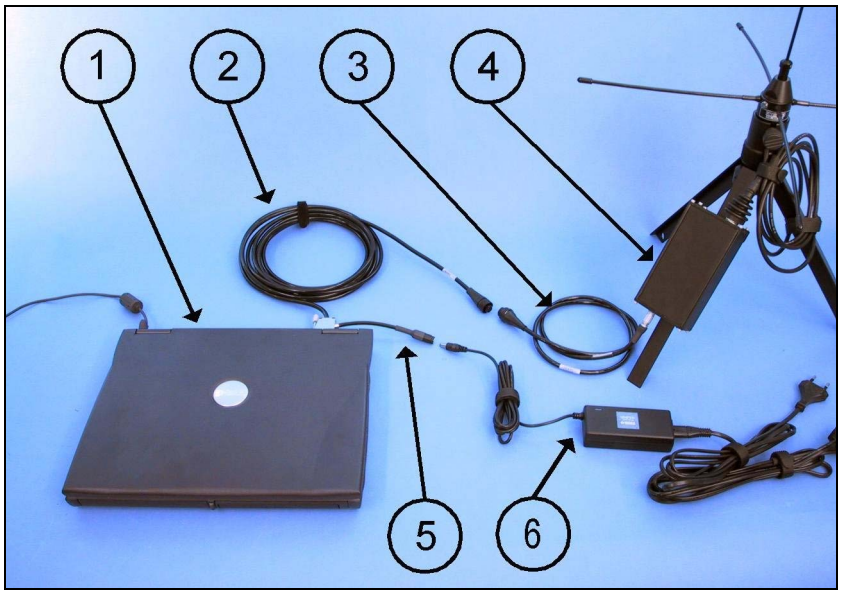

Figure 115 Connecting the Radio Modem to PC

5. Connect the appropriate antenna cable and data/power cable (number 3 in Figure 115 on page 133) to the radio modem (4).
6. Connect the PC cable (2) to the PC (1).
7. Connect the power supply (6) to the DC connector (5) of the PC cable (2).
8. Connect the power supply to the AC (mains) outlet.
9. Place the antenna with the tripod in such a way that there is a line of sight between the antennas.

CHAPTER 6

TECHNICAL DATA

This chapter provides the technical data of the TACMET Weather Station for Pole Mast Installations.

Polling/Reporting Times

Table 12 Sensor Polling/Reporting Times

Parameter	Polling	Reporting
Wind direction (WS425)	1 s	5 s
Wind speed (WS425)	1 s	5 s
Air temperature (QMH101M)	10 s	1 min
Relative humidity (QMH101M)	10 s	1 min
Air pressure (PMT16A)	10 s	1 min
Precipitation (QMR101M)	1 min	1 min
Lightning (SA20M)	5 s	5 s
Sky condition (CT25KAM)	30 s	30 s
Present weather (PWD11A)	30 s	30 s

Specifications

Weather Station MAWS201MP

Table 13 MAWS201MP Specifications

Property	Description/Value
AC power consumption	260 VA, max. 2.3 A @ 115 VAC 1.15 A @ 230 VAC
Battery backup time	4 h, at minimum (excluding PC equipment; optional UPS for PC equipment)
Communication range with the QCA101 unit equipped with WT501+DMX501	20 km (12 mi.) with AWG 22 cable
Temperature	-40 ... +55 °C (-40 ... 131 °F)
Humidity	5 ... 100 %RH
Wind	0 ... 50 m/s (0 ... 100 knots)

Logger QML102T

Table 14 QML102T Specifications

Property	Description/Value
Processor	32-bit Motorola
A/D conversion	16-bit
Data logging memory	1.7 Mbytes internal Flash memory
Sensor inputs	10 Analog inputs (20 single ended inputs) 2 counter / frequency inputs Internal channel for PMT16A pressure transducer
Typical accuracy across measured temperature range -50 °C ... +80 °C	Better than ± 0.06 °C
Maximum error across measured temperature range -35 °C ... +50 °C	Less than ± 0.12 °C
Maximum error at 0 °C	Less than ± 0.06 °C
Voltage measurement ±2.5V range ±250 mV range ±25 mV range ±6.5 mV range	 Better than 0.08 % F.S. ± 150 μV Better than 0.18 % F.S. ± 15 μV Better than 0.18 % F.S. ± 3 μV Better than 0.18 % F.S. ± 3 μV
Frequency measurements	0.003 % + resolution 241 ns (up to 2 kHz)
Common mode range	+5 V / -4 V
Real-time clock Standard	 Better than 20 sec/month
Serial communication Standard Optional	RS-232 for maintenance 2 pcs RS-232 for handheld display and laptop PC (max. distance 70 m) 2 pcs RS-485 for smart sensors and remote displays, speed 300 ... 4800 bps (max. distance 2.5 km)
Voltage (external powering)	8 ... 14 VDC recommended (30 V max)
Standard internal battery	1.2 Ah/6 V
Temperature (operating)	-40 ... +55 °C (-31 ... 131 °F)
Temperature (storage)	-50 ... +70 °C (-58 ... 158 °F)
Humidity	0 ... 100 %RH
Emissions	CISPR 22 class B (EN55022)
ESD immunity	IEC 61000-4-2
RF field immunity	IEC 61000-4-3
EFT immunity	IEC 61000-4-4
Surge (lightning pulse)	IEC 61000-4-5
Conducted RF immunity	IEC 61000-4-6

Power Supply and Connection Unit QMP202MP

Table 15 Battery Regulator QBR101 Specifications (Inside QMP202MP)

Property	Description/Value
Maximum input voltage (SMPS and Solar Panel inputs)	30 VDC
Maximum input current (SMPS)	6 A
Solar panel input	55 W max.
Recommended input voltage from SMPS input	16 VDC
Max. load current (backup output)	3.5 A
Recommended battery capacity range	4 … 72 Ah
Battery charge current for 4 Ah battery (selections 0.5 / 1.0 / 2.0 / 2.5 A)	0.5 A
Max. battery discharge current	3.5 A
Battery charge voltage selection (with external resistor)	13.7 V
Battery charge temp. comp. Coefficient	-20 mV/°C, typical
Load disconnection threshold voltage (with Lo Btry Switch)	10.0 V, typical
Load reconnection threshold voltage	12.0 V, typical
Battery Low signal threshold voltage	11.5 V, typical
Self consumption from battery (with LEDs disconnected)	0.2 mA max. @ +25 °C
Ground connection	Negative
Reverse voltage protection	Battery, solar panel
Wire terminals - battery and load wires - solar panel, DC input, and controls	Screw terminals, removable 2.5 mm^2 1.5 mm^2
MTBF (parts stress method, MIL.HDBK 271F ground benign Ta +25 °C)	> 150 000 hours
Housing	Anodized aluminum, gray
Dimensions w × d × h	90 × 80 × 25 mm (3.5 × 3.1 × 1 in)
Weight	0.1 kg (3.5 oz)

Table 16 Power Supply Unit BWT36SXZ Specifications (Inside QMP202MP)

Property	Description/Value
Output power	30 W
Operating principle	SMPS
Input voltage range	85 … 264 VAC
Frequency range	47 … 440 Hz
Input current on full load: 100 VAC 230 VAC	 0.6 A 0.4 A
Output voltage	+36 V, adjustable ± 10%
Output current	0.9 A
Efficiency	81 %
Noise and ripple	(Output V × 0.01) + 50 mV_{p-p}, max.
Input regulation	0.8 % max.
Load regulation	0.9 % max.
Temperature coefficient	± 0.03 %/°C
Output voltage rise time	200 ms max. at +25 °C
Hold-up time	20 ms min. at +25 °C
Over current protection	Foldback, automatic recover
Switching frequency (110VAC/230VAC)	50 kHz/80 kHz
Electrical strength/ isolation: Input - Output Input - Chassis Output - Chassis Input - Output - Chassis resistance	 3 kV AC, 1 minute 2.5 kV AC, 1 minute 500 V AC, 1 minute 50 MΩ minimum
Leakage current	0.75 mA max.
Operating temperature range	-40 ... +60 °C (-40 ... 140 °F)
Weight with chassis	250 g (8.8 oz)
Approvals	UL 1950 CSA 234 (IEC 950) VDE0805 EN 60959 (IEC 950) CE - EMC 89/336 EEC - LVD 73/23 EEC

Table 17 Power Supply Unit BWC15SXZ Specifications (Inside QMP202MP)

Property	Description/Value
Output power	75 W
Operating principle	SMPS
Input voltage range	85 … 264 VAC
Frequency range	47 … 440 Hz
Input current on full load: 100 VAC 230 VAC	 1.7 A 0.9 A
Output voltage	+15 V, adjustable ± 10%
Output current	5 A
Efficiency	84 %
Noise and ripple	(Output V × 0.01) + 100 mV_{p-p}, max.
Input regulation	0.8 % max.
Load regulation	0.9 % max.
Temperature coefficient	± 0.03 %/°C
Output voltage rise time	300 ms max. at +25 °C
Hold-up time	20 ms min. at +25 °C
Over current protection	Current limiting
Switching frequency (110VAC/230VAC)	135 kHz
Electrical strength/ isolation: Input - Output Input - Chassis Output - Chassis Input - Output - Chassis resistance	 3 kV AC, 1 minute 2.5 kV AC, 1 minute 500 V AC, 1 minute 50 MΩ minimum
Leakage current	0.75 mA max.
Operating temperature range	-40 ... +60 °C (-40 ... 140 °F)
Weight with chassis	300 g (10.6 oz)
Approvals	UL 1950 CSA 234 (IEC 950) VDE805 EN 60959 (IEC 950) CE - EMC 89/336 EEC - LVD 73/23 EEC

Table 18 12 Ah Backup Battery Specifications

Property	Description/Value
Type	Sealed, Lead-acid
Nominal voltage	12 V
Nominal capacity	12 Ah (provides minimum of 4-hour service length without AC power)
Self discharge	3%/month
Expected lifetime	4 … 5 years
Dimensions w × d × h	151 × 98 × 94 mm (5.9 × 3.9 × 3.7 in)
Weight	4 kg (8.8 lb.)

Digital Transmitter WT501

Table 19 WT501 Specifications

Property	Description/Value
Type	Low Power Digital Transmitter running 16-bit CPU and ADC
Features	IP30/Nema 1 housing with screw terminals
	Online configurable, parameters stored into a non-volatile EEPROM
	Separately isolated power input, serial input and RS485 I/O
Plug-in connectors	46 pcs on PCB, removable connectors with screw terminals, 1.5 mm^2 maximum wire
Start-up voltage	12 to 50 VDC. Shut down level ≤ 10 VDC, start-up level ≥ 10 VDC 50 V abs. max
Power consumption	With default configuration 15 mA @ 12 VDC in; 7.5 mA @ 24VDC including sensors
	With extreme configuration 50 mA @ 12 VDC in; 25 mA @ 24 VDC
Modem module	25 mA @ 12 VDC in; 12.5 mA @ 24VDC
Power isolation	100 VDC peak (limited by a 100 V varistor to unit case)
RS-485 isolation	100 VDC peak (limited by a 100 V varistor to unit case)
On board	Opto-isolated RS-485 (2-and 4-wire) I/O
Optional	Communication module interface for non-isolated RS-232, isolated RS-485, leased-line modem
Modem and power	Possibility to use modem connection where power and modem data are on the same 2-wire line.
Mounting	30 mm DIN-rail
Weight	0.4 kg (14.1 oz)
Operating temperature	-40 ... +60 °C (-40 ... 140 °F)
Storage temperature	-50 ... +70 °C (-58 ... 158 °F)
Humidity operating and storage	2 ... 95 %RH
EMC	CE compliant
Vibration	According to MIL-STD-167-1

Modem Module DMX501

Table 20 DMX501 Specifications

Property	Description/Value
Modem chip	73K324L
Modem chip crystal frequency	11.0592 MHz
USART clock frequency	11.0592 MHz / 2
Register access	Operated through an 8-bit bus interface
Connection	2-wire Point-to-point line or multidrop modem network
Modem protocols	V.21, 300 bps FSK V.23, 1200 / 75 bps FSK V.22, 1200 bps DPSK
Line interface	Matched to 600 Ω
TxControl signal	Configurable
Supply voltage	5 V (+4.75 ... +5.50 V)
Current consumption Reset / power-down Operation	 9 mA 26 mA
Transmit level	-10 dBm
Maximum distance between modules	20 km (~12 mi.) with 22 AWG standard cable
Operating and storage temperature	-50 ... +70 °C (-58 ... 158 °F)
Humidity	0 ... 100 %RH, non condensing

Handheld Terminal QMD101M

Table 21 QMD101M Specifications

Property	Description/Value
CPU	MC68EC000 24-Bit external and 32-Bit internal address 16-Bit on-chip bus for MC68EC000 bus operations
Power management	Static Design allows processor clock to be stopped
Clock speed	16.54 MHz
System integration	16 programmable peripheral chip selects. Interrupt controller with 13 flexible inputs. Programmable interrupt vector generator. Hardware and software watchdog timer. Lower power mode control.
System RAM	256 Kbytes or 1 MB SRAM
FLASH storage	512 Kbytes, 1 MB, or 2 MB
Display Physical size Pixels Character cell size CG set LCD type	Graphics LCD 89 x 91 mm (3.5 x 3.57 in) 160 x 160 8 x 16 (10 rows x 20 columns) or 6 x 10 (16 rows x 26 columns) 256 PC character set & 16 programmable characters Reflective LCD with programmable contrast
Option for display	EL Backlight
Keyboard	25 KEYS
Size	5 columns x 5 rows
Type	Elastomer (Rubber Dome)
Feedback	Audio speaker
Real time clock	24 Hour plus battery backed Month/Day/Year
Interface	14 pin quick connect micro connector or internal
Data transfer rate	Programmable to 38.4 Kb/s
Handshaking	RTS/CTS, Xon/Xoff by the processor
External power	5 ... 14 VDC unregulated, via RS-232 interface (Pin 1 on the 9 pin RS232 D-Sub via pins 13 & 14 Micro Connector).
Current	17 mA @ 6 VDC typical. 80 mA worst case during FLASH write. 0.6 mA sleep mode
Size	191 x 102 x 33 mm (7.5 x 4.0 x 1.3 in) without case expansion ring
Weight	450 g (1 lb)
Operating temperature	-20 ... +70 °C (-4 ... 158 °F)
Operating humidity	Max. 90 %RH non-condensing

Heated Ultrasonic Wind Sensor WS425

Table 22 WS425 Specifications

Property	Description/Value
Sensor type	Ultrasonic 100 kHz Fully compensated for temperature, humidity, and altitude.
Measuring range	0 ... 56 m/s (0 ... 125 mph, 0 ... 107 knots) 0 … 130 m/s (survival)
Delay distance	Virtually zero
Starting threshold	Virtually zero
Response characteristics	Maximum reading rate: 1 per second Sonic measurement time: 0.2 second Signal processing time: 0.15 second Response time: 0.35 second
Accuracy (wind speed)	±0.135 m/s (0.3 mph, 0.26 knots) or 3 % of reading, whichever is greater
Accuracy (wind direction)	±2 degrees
Resolution (wind speed)	0.1 m/s (0.1 mph, 0.1 knots, 0.1 km/h)
Resolution (wind direction)	1 degree
Power (operating)	10 ... 15 VDC, 12 mA (analog)
Power (heating)	36 VDC ± 10 %, 0.7 A
Heater	Thermostatically controlled heaters in the transducer heads prevent freezing rain or snow build up.
Output (analog wind speed)	10 Hz/0.894 m/s (0 ... 625 Hz at 0 ... 55.88 m/s) (frequency) 10 mV/0.558 (0 ... 1.0 volt at 0 ... 55.88 m/s) (voltage)
Output (analog wind direction)	(0 to V_{ref} at 0 to 359°) (simulated potentiometer) 1.0 ... 4.0 VDC, for 5.0 VDC reference an additional -2° error occurs for angles greater than 291° (reference voltage)
Available averages	1 ... 9 seconds (RS-232)
Dead band (wind direction)	None
Material	Stainless steel body and sensor arms Silicone rubber and PVC transducer heads
Operating temperature	-50 ... +50 °C (-58 ... -122 °F)
Dimensions w × d × h	250 × 286 × 355 mm (9.8 × 11.2 × 13.9 in)
Weight	1.7 kg (3.7 lb)
Mean time between failure (MTBF)	26 years calculated per the standard assumptions of MIL-HDBK-217, Revision E.
EMC compliance	EMC standard EN61326-1:1997 + Am1: 1998; Generic Environment

Pressure Sensor PMT16A

Table 23 PMT16A Specifications

Property	Description/Value
Accuracy	± 0.3 hPa incl. one year drift (with factory calibration)
Pressure range	600 ... 1100 hPa
Operating temperature	-40 ... +60 °C (-40 ... 140 °F)

Air Temperature and Relative Humidity Sensor QMH101M

Table 24 QMH101M Specifications

Property	Description/Value
Range (Temperature)	-40 ... +60 °C (-40 ... 140 °F)
Range (RH)	0 ... 100 %
Accuracy (Temperature)	Better than ± 0.3 °C
Accuracy (RH)	± 2 %, 0 ... 90 % ± 3 %, 90 ... 100 %

Rain Gauge QMR101M

Table 25 QMR101M Specifications

Property	Description/Value
Sensor/transducer type	Self-emptying tipping spoon/magnet
Funnel diameter	159.6 mm (6.28 in)
Orifice (opening area)	200 cm^2 (31 in^2)
Sensitivity	0.2 mm (1/128 in)
Capacity	144 mm/h (5.7 in/h)
Accuracy < 24 mm/h < 120 mm/h	 < ± 5 % < ± 10 %
Material	UV stabilized plastic
Cable	Included
Weight	380 g (13.4 oz)

Ceilometer CT25KAM

Table 26 CT25KAM Specifications

Property	Description/Value
Measurement range	0 ... 25 000 ft (0 ... 7.5 km)
25 000 ft acquisition time	15 s
Accuracy (against hard target)	± 2 % ± 1/2 × [resolution]
Resolution	50 ft
Number of layers	Up to 5
Range gates	500
Laser	Pulsed diode, InGaAs MOCVD
Wavelength	905 nm ±5 nm at 25 °C (77°F)
Eye safety	In compliance with IEC825 and 21CFR1040
Measurement cycle	Programmable 15 ... 120 s
Microprocessor	Intel 16-bit CMOS 80C188EB
DC power consumption total measurement unit window blower	 20 W 15 W 5 W
AC power	115 or 230 VAC, 45 ... 65 Hz max. 240 W including heating, ± 15 %
Interfaces	RS-485
Data messages	Cloud hits and status only. Cloud hits, status, internal monitoring data, and full backscatter profile.
Dimensions w × d × h	316 × 256 × 710 mm (12 × 10 × 28 in)
Weight	14.5 kg (32 lb.)
Tilt correction sensor	Correction 0 ... 60°
Window conditioner	Automatic window blower and protection shield.
Temperature range	-50 ... +60 °C (-58 ... 140 °F)
Humidity	0 ... 100 % RH
Protection class	IP65
Vibration during operation	0.5 G, 10 ... 500 Hz (IEC68-2-6 FC)
EMC/EMI	CISPR 22B/FCC 15 Part J or IEC801-5 (2 kV), 3 V/m 14 kHz-1 GHz IEC801-3 IEC 801-4 Level 3
Static	8 kV (IEC801-2 Level 4)
Electrical safety	EN60950

Present Weather Detector PWD11A

Table 27 PWD11A Present Weather Detector Specifications

Property	Description/Value
Measurement range of MOR	10 ... 20 000 m (32 ... 65 600 feet)
Accuracy	±10 %, range 10 ... 10 000 m (<32800 ft) ±15 %, range 10 ... 20 km (32800 ... 65600 ft)
Maximum power consumption	15 W without heating, max 20 W 10 ... 50 VDC
Time constant	60 seconds
Update interval	15 seconds
Precipitation detection sensitivity	0.05 mm/h or less, within 10 minutes
Weather type identification	7 different types of precipitation (rain, freezing rain, drizzle, freezing drizzle, mixed rain/snow, snow, ice pellets) Precipitation (unknown type) Fog (mist), haze (smoke, sand) or clear
Weather type reporting	WMO code table 4680
	Code letters for precipitation, NWS (National Weather Service, USA)
Precipitation intensity measurement	Range 0.00 ... 999 mm/h
	Accuracy ±30 % (range 0.5 ... 20 mm/h, liquid precipitation)
Sun orientation	Sunlight into the light receiver must be avoided
Material	Anodized aluminum, black
Wind speed	Up to 60 m/s (116 knots)
Operating temperature range	-40 ... +55 °C (-40 ... 131 °F)
Operating humidity range	Up to 100 %RH
Dimensions w × d × h	720 × 320 × 220 mm (28.3 × 12.6 × 8.66 in)
Weight	2.8 kg (6.17 lb.)

Lightning Detector SA20M

Table 28 SA20M Specifications

Parameter	Description/Value
Types of strikes detected	Cloud-to-cloud Cloud-to-ground
Maximum processing rate	5 000 strikes per minute
Operational Limits Range Bearing	 0 ... 90 km (0 ... 50 nmi.) 0º ... 360º
Resolution: Range Bearing	 2 km (1 nmi.) 1 degree
Ranging accuracy	± 1 km (0 ... 28 km); ± 0.5 nmi. (0 ... 15 nmi.) ± 2.4 km (28 ... 55 km); ± 1.3 nmi. (15 ... 30 nmi.)
Directional accuracy	± 5º
Power	10 ... 18 VDC, 7 W, 0.5 A (typ) @ 13.8 VDC
Transient voltage surge protection	All lines
Weight	3.6 kg (8 lb.)
Dimensions w × d × h	310 x 310 x 130 mm (16 x 16 x 5 in)
Temperature	-35 ... +55 °C (-30 ... 130 °F)
Humidity	5 ... 100 %RH condensing
Standards	FAA Advisory Circular 150/5220-16 RTCA/DO-191 TSO-C110a

Obelux Obstruction Light

Table 29 Obelux Obstruction Light Specifications

Property	Description/Value
Intensity	17 cd typical
Radiation pattern	360° horizontal 50° vertical
Illumination threshold	200 lux (adjustable)
RF-radiation	None
LEDs	14 separate groups
Power consumption	< 2 W
Current consumption	< 0.17 A
Height	235 mm (9.25 in)
Diameter	120 mm (4.72 in)
Glass cover thickness	5 mm (0.2 in)
Operating temperature range	-55 ... +55 °C (-67 ... 130 °F)

Tiltable Pole Mast

Table 30 DKP210AV-T Specifications

Property	Description/Value
Height	10 m (32.8 ft)
Maximum wind speed with two sets of guy wires	 67 m/s (130 knots)
Diameter Lowest section (0 ... 1.9 m) Second section (1.9 ... 4.9 m) Third section Highest section Top of the mast	 100 mm (3.94 in) 75 mm (2.95 in) 63 mm (2.48 in) 50 mm (1.97 in) 60 mm (2.36 in)
Mast tubes and lifting rod	Aluminum alloy
Pedestal tube and hinge	Stainless steel
Other parts, e.g., bolts	Stainless steel
Guy wires Material Breaking strength Marking	 Stainless steel 28 kN (6 295 lbf) Black and yellow colored cable shrouds to the height of 2 meters from the ground
Foundation set Material Thread of foundation bolts Length of foundation bolts Wedge bolts	 Galvanized steel M20 300 mm (11.8 in) M20, cast or drilled into concrete using the provided orientation plate as a guide
Coating/Painting Pedestal tube and hinge Aluminum parts Steel parts Stainless steel parts	 Corrosion-resistant powder coating Anodized and painted Galvanized Uncoated
Mast concrete base	Soil bearing capacity must exceed 45 kPa
Weight (pole with winch)	125 kg (276 lb)

Table 31 DKP206AV-T Specifications

Property	Description/Value
Height	6 m (19.7 ft)
Maximum wind speed With one set of guy wires	 65 m/s (126 knots)
Diameter Lowest section (0 ... 1.9 m) Second section (1.9 ... 4.9 m) Highest section Top of the mast	 100 mm (3.94 in) 75 mm (2.95 in) 63 mm (2.48 in) 60 mm (2.36 in)
Mast tubes and lifting rod	Aluminum alloy
Pedestal tube and hinge	Stainless steel
Other parts, e.g., bolts	Stainless steel
Guy wires Material Breaking strength Marking	 Stainless steel 28 kN (6 295 lbf) Black and yellow colored cable shrouds to the height of 2 meters from the ground
Foundation set Material Thread of foundation bolts Length of foundation bolts Wedge bolts	 Galvanized steel M20 300 mm (11.8 in) M20, cast or drilled into concrete using the provided orientation plate as a guide
Coating/Painting Pedestal tube and hinge Aluminum parts Steel parts Stainless steel parts	 Corrosion-resistant powder coating Anodized and painted Galvanized Uncoated
Mast concrete base	Soil bearing capacity must exceed 45 kPa
Weight (pole with winch)	105 kg (231 lb)

TM32 Radio Modem

Table 32 TM32 Radio Modem Specifications

Property	Description/Value
Interface	RS-232 compatible interface. User configurable for common baud rates to 38,400 and parity. Interface does not require hardware handshake control.
Power	External power supply range of 10 ... 26 VDC. RF - 1.2W, 10.2W during TX.
Link rate	2400 or 4800 baud (optionally 9600 baud)
Transmission protocols	Fast asynchronous, transparent, packet switched, digipeater, or TDMA.
Modulation	Gaussian Minimum Shift Keying (GMSK) baseband modulation with programmable transmit BT of 0.5 or 0.3.
FEC protocol	Hamming code (12,8) with data interleave for burst error correction up to 20 consecutive bits in transparent and packet modes of operation.
General radio specifications	Synthesized frequency control. Channel spacing resolution of 6.25, 12.5 kHz, or 25kHz depending on model. Frequency stability of 5 ppm.
Transmitter	Modulation distortion <5%. Duty cycle 100%. Transmitter attack time 10 ms. Spurious and harmonic FM -55 dBc. FM hum and noise -40 dB.
Receiver	Sensitivity -114 dBm (12 dB SINAD). Adjacent channel selectivity -60 dB (25 kHz). Spurious and image rejection -60 dB. Intermodulation -60 dB. FM hum and noise -40 dB. Conducted spurious -57 dBm.
RF connector	Environmentally sealed BNC (50 W)
Type acceptance	All models are type accepted and certified for operation in the U.S. and Canada.
Operating temperature	-22 ... 140 °F (-30 ... +60 °C)
Storage temperature	-67 ... 185 °F (-55 ... +85 °C)
Vibration/Shock	IEC 68-2-55
Enclosure	IEC 144/855420 IP 66 Dust-tight and watertight.
Dimensions w × d × h	70 × 23 × 132 mm (2.75 × 0.9 × 5.2 in)
Weight	255 g (9 oz) excluding cable